

Mining

CONGRESS JOURNAL



JUNE
1958



AMC COAL CONVENTION REPORT ISSUE

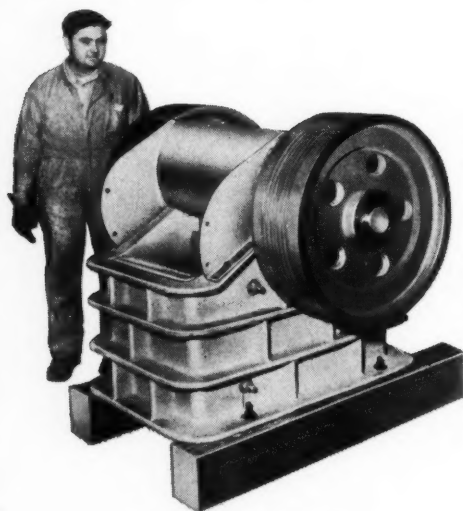
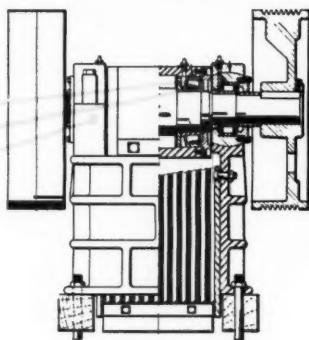
Quick Delivery...

DENVER Forced Feed JAW CRUSHERS In Stock!

Anti-friction
bearings:

Here
Here
Here

in all sizes,
5" x 6" through
10" x 20", Type "H"
DENVER Jaw Crushers



Shipment from stock in sizes
5" x 6", 8" x 10", 10" x 16" and
10" x 20". Other sizes to 36"
x 48" are available.

Dealer Inquiries Invited

To provide the quickest possible delivery, DENVER Equipment Company maintains a complete stock of all sizes from 5" x 6" to 10" x 20" DENVER Forced Feed Jaw Crushers in Colorado Springs, Colo. Also, dealer stocks in many parts of the country.

A telephone call brings action to solve your size reduction problem. Recommendations, specifications, prices on request.

Now—Roller Bearings Throughout... for Long Life, Low Maintenance Cost

- Anti-friction roller bearings in side frame and bumper. Crusher runs smoother, bearings last longer, maintenance costs reduced.
- Side bearings in carrier permits bumper removal without exposing bearings to dirt.
- Side bearings on 10" x 16" and 10" by 20" sizes set in ball and socket type mounting for perfect self-alignment.
- Reinforced cast steel frame ends breakage.
- Manganese steel jaw and cheek plates for extra long service.
- Jaw plates reversible for long service, low maintenance costs.
- Pressure grease lubrication and labyrinth dust seals.



"The firm that makes its friends happier, healthier and wealthier"

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Mining

CONGRESS JOURNAL

JUNE, 1958

VOLUME 44

NUMBER 6

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Circulation
M. D. Taylor

Published Monthly. Yearly subscriptions, United States, Canada, Central and South America, \$3.00. Foreign, \$5.00. Single copies, \$0.30. February Annual Review Issue, \$1.25. Entered as Second-class Matter, January 30, 1915, at the Post Office at Washington, D. C.

Member
Audit Bureau of Circulation



Indexed regularly by Engineering Index, Inc.

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Helping to "HOLD THAT ROOF!"



"Hold That Roof!" is the title of a 27-minute, sound-color film produced by Ohio Brass to promote a better understanding of bolting principles and practices among underground production workers and bolting crews.

The film, which has already been shown to over 10,000 mining men, is available through local O-B representatives for scheduled showings at individual mine properties.

Why not ask your O-B representative for a "preview" showing to see how "Hold That Roof!" will fit into your bolting training program or safety campaign?

OHIO BRASS COMPANY, MANSFIELD, OHIO
Canadian Ohio Brass Co. Ltd., Niagara Falls, Ont.

Ohio Brass

4831-M

have your
bolting crews
seen it yet?

"hold that roof!"

"suggested installation
procedures for
safe roof bolting"

a 27-minute
sound-color film
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representatives for
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own property

already viewed
by over 10,000
mining men!

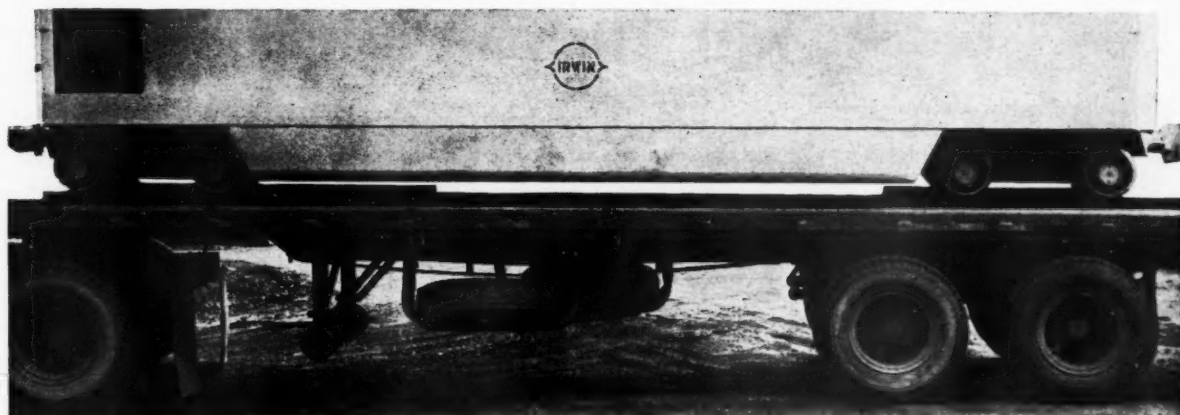
see your O-B
representative
or write direct to
Ohio Brass Co.



Another

IRWIN 8-WHEEL STREAMLINER

On Its Way to Cut Coal Transportation Costs

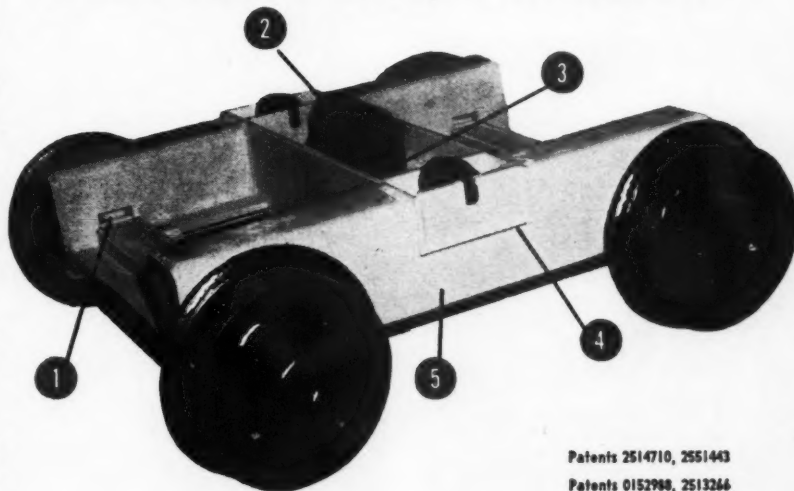


Shown is one of a large order of high capacity 8-wheel Irwin Streamliners recently purchased by a large Northern West Virginia mine. This mine has found, as others are finding, how Irwin's salesmen and engineers work with them in solving their haulage problems. If you are having difficulty with

your present 4-wheel trucks or inadequate and obsolete haulage equipment, contact Irwin and let one of their salesmen show you how your haulage can be re-modernized through the use of high-capacity 8-wheel all-steel Streamliners.

ALL-WELDED MINE CAR TRUCK

- 1 Knee action trucks featuring double springs at each wheel giving smoother performance.
- 2 Irwin patented king-pin assembly allows flexibility in all directions; eliminates binding and over-stressing of structural members.
- 3 Irwin's special self-lubricated bronze bearings give carefree service (external greasing system for those who desire it for added protection).
- 4 Irwin rigid box frame construction gives better truck roadability; reduces flange wear to a minimum.
- 5 Every Irwin truck is custom engineered for the load it will carry and operating conditions; can be supplied in any track gauge or wheel base.



Patents 2514710, 2551443
Patents 0152988, 2513266
Patent Pending

WRITE TODAY FOR COMPLETE DETAILS.

Serving the Coal Industry Since 1904

IRWIN

FOUNDRY & MINE CAR COMPANY

Phone Underhill 3-5000

IRWIN, PA.

Box 311

3 new applications get longer life and minimum maintenance using Dodge pillow blocks with Timken® bearings

PICTURED below are three applications where Timken bearing equipped Dodge pillow blocks stay on the job with little attention under tough conditions. Their tapered design lets Timken® bearings take *both* radial and thrust loads in any combination. And full-line contact between rollers and races provides extra load-carrying capacity. Wear is reduced, maintenance is cut to the minimum.

Cutaway view shows the Dodge

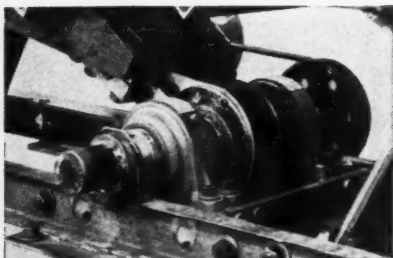
All-Steel pillow block with Timken bearing mounting. Of special design, the bearing has a tapered bore with self-aligning spherical outer surface—never needs adjustment.

Besides the All-Steel pillow block, other versatile Dodge pillow blocks with Timken tapered roller bearings are: Type "E", Double-Interlock, Type "C" and Special Duty. All are compact in design. Special thrust devices that take up extra space are not needed.

And to get the finest steel for Timken bearings, we make it ourselves—America's only bearing manufacturer that does. So specify bearings trademarked "TIMKEN" for the machines you buy or build. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".



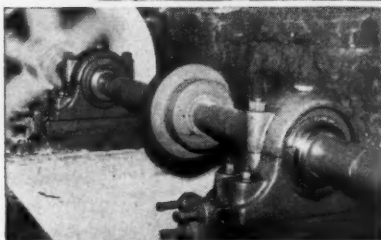
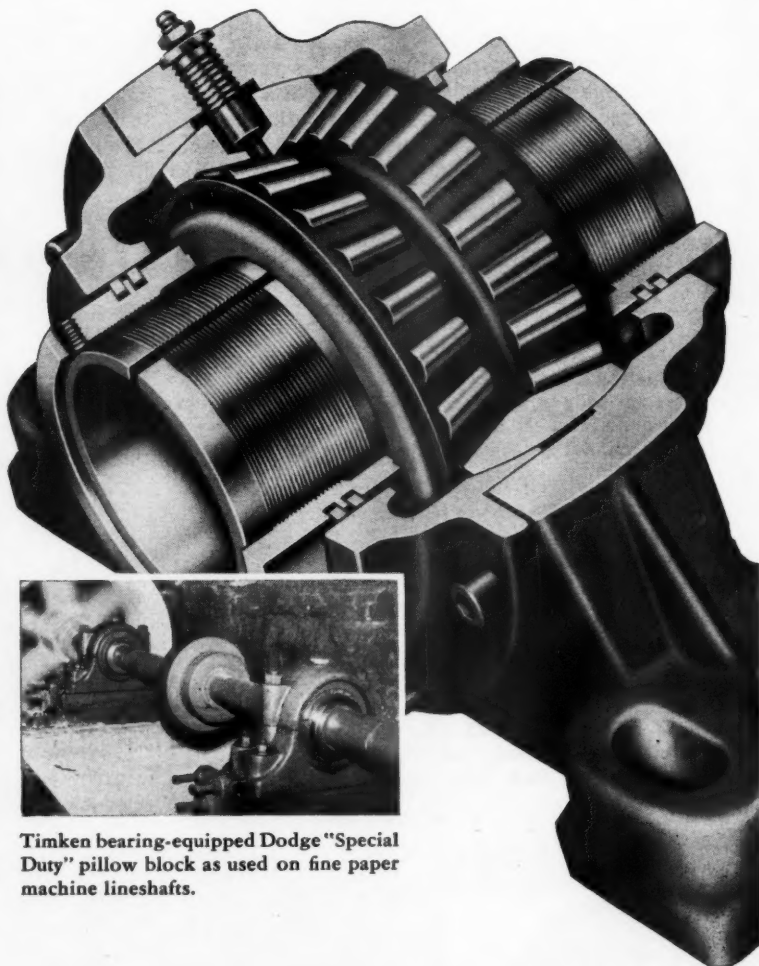
This symbol on a product means its bearings are the best.



Timken bearing-equipped Dodge All-Steel pillow block used in a vibrating conveyor.



Timken bearing-equipped Dodge Type "E" pillow block used in sand and gravel plant.



Timken bearing-equipped Dodge "Special Duty" pillow block as used on fine paper machine lineshafts.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS ROLL THE LOAD

Why use separate machines and operators on scattered tractor jobs?

Handle your widely-separated pit maintenance and clean-up jobs swiftly and economically with one man and a LeTourneau-Westinghouse Tournatractor®. Rubber-tired tractor speeds to the job under its own power . . . over RR tracks, paved roads, down shot banks, or cross country. There are no delays for load-and-haul to new locations.

L-W tractor gives you better speed at the work area, too. Acceleration is fast, with 210 hp operating through sealed anti-friction drive. Maneuverability is quick and easy. Also, there's no loss of momentum to shift gears, because this tractor's gears are constantly in mesh. Even reverse action is *instant*.

Handles wide variety of jobs

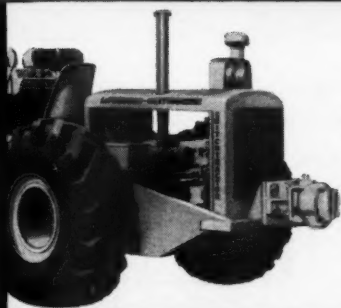
You can use Tournatractor to clean around 2 or more shovels . . . to main-

tain stockpiles, level waste dumps, clean debris off RR tracks . . . to clean benches, handle shallow stripping . . . to tow air-compressors, or pull supply and service wagons. You can even use this speedy, mobile tractor for maintenance and clean-up in one or more adjoining pits.

Biggest tractor value today!

In addition to giving you these plus operating advantages, LeTourneau-Westinghouse Tournatractor *costs less* than a track-type tractor of comparable horsepower. Let us demonstrate this rubber-tired tractor at your pit. Watch it perform under *your* working conditions. You'll find it can handle scattered tractor jobs faster, more efficiently, to help cut pit costs.

†Trademark CT-1865-MQ-1



With standard type E railway coupler — one of ten multi-service Tournatractor attachments available — this speedy, powerful tractor becomes a versatile off-track switcher, as well. Use it to spot and group rail-cars fast. Big tires on SwitchTractor† straddle rails, ride on ballast and tie-ends — deliver double the tractive effort of steel-wheeled switchers, rolling on smooth steel rails.



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A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

for **HIGH** speed
in
LOW
seams . . .

CP HYDRAULIC COAL DRILL



Low, tough seams need a light, easily handled Chicago Pneumatic Hydraulic Coal Drill. Weighs only 35 pounds. Drills a 9 foot hole in 30 seconds. With auger speeds less than 1000 RPM, vibration is held to a minimum. Makes long augers easy to handle.

The CP-35-HCD will operate off the power system of cutting, timbering or roof bolting machines. Complete safety—no sparks or shock possible. No kick, no stall. Write for details: *Chicago Pneumatic Tool Company, 8 East 44th Street, New York 17, New York.*

AVAILABLE ACCESSORIES INCLUDE: Valves, gauges, junction blocks, hoses and fittings.



Chicago Pneumatic

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This is the time to

**IMPROVE YOUR COMPETITIVE
POSITION with a**

FAIRMONT PREPARATION PLANT

PROFIT

TONNAGE

The evidence is everywhere, throughout all business, competition is becoming more keen—more aggressive. This is no less true in the coal industry where it is quite evident that to the alert, progress-minded operator will go the sales which spell TONNAGE and PROFIT.

To mechanize is wise but this alone is not enough. The trend is clear—users want a clean,

upgraded product—a product in demand—a product which commands a better price—a product possible when you clean and grade your coal in a FAIRMONT-designed and constructed preparation plant.

Here then is how to match and outstrip competition and make money doing it—put your coal through a Fairmont cleaning plant—the plant that guarantees product uniformity and over 99% separating efficiency through an extra wide product size range of $\frac{1}{8}$ " to 10" in any tonnage capacity.

Why be satisfied with less than the best when you can have the best simply by lifting your phone and calling Fairmont, W. Va. 1672.

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FAIRMONT, WEST VIRGINIA

DESIGNERS AND CONSTRUCTORS OF COMPLETE PREPARATION PLANTS USING BOTH WET AND DRY CLEANING, CENTRIFUGAL AND THERMAL DRYING.

NEW...FROM JOY LOW SEAM SHUTTLE CAR HAULS 4½ TONS

You can cut low seam haulage costs in *half* and speed up your entire operation with this completely new shuttle car. The reason for the 18-SC's greater capacity is its unique six-wheeled design. Joy engineers *added* another wheel to each side of the car, reduced the size of all wheel units, and hinged the car in the middle. The result is an extra-large conveyor, 6 feet wide and 27 feet long that empties 4½ tons in 27 seconds.

DRIVE WHEELS IN MIDDLE OF CAR—The two center wheels are used for the traction drive. Each wheel is driven independently by a 10 HP motor through a reducer and chain and sprocket, thus eliminating transmissions, torque converters and differentials.

FOUR WHEEL STEERING—The two wheels at both ends of the car are steered hydraulically by twin boosters on each side of the car, and are controlled from the centrally located operator's station. The 18-SC has an inside turning radius of 11 feet.

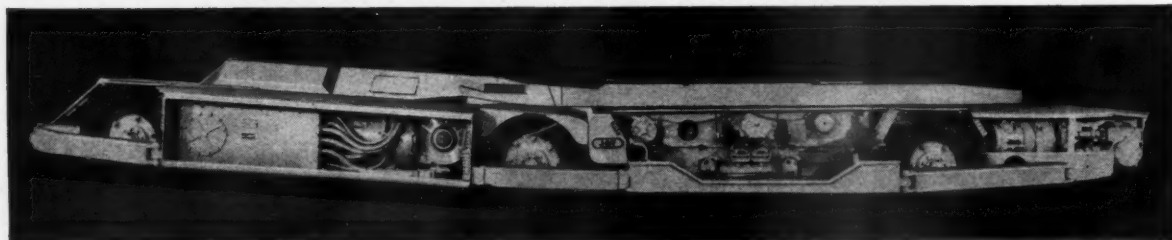
ELIMINATION OF EXPENSIVE WHEEL UNITS—Since each of the six wheels is used *only* for steering or *only* for traction, the wheel units are extremely simple . . . easy and inexpensive to maintain.

UNIQUE SUSPENSION . . . NO AXLES . . . WHEELS HUG ROUGH BOTTOM—The four wheels used for steering are individually pivot-mounted to permit two wheels at one end to assume different elevations while the car bed remains level. This suspension, combined with the articulated mid-section, makes the 18-SC completely flexible throughout its length and width. Also, maximum ground clearance, since there is no axle running under the car.

Other models are available for work in higher seams. Talk to a Joy engineer. Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa. In Canada: Joy Manufacturing Company (Canada) Limited, Galt, Ontario.



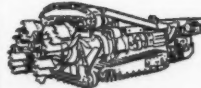
BENDS UP-AND-DOWN IN THE MIDDLE—For maximum flexibility under all conditions, the 18-SC is hinged across the width of the car, near the traction wheels. When climbing up and down small rises and depressions the car actually bends in the middle, keeping the wheels in contact with the ground at all times. This hinged design also permits running the discharge end of the car up a ramp when an elevated discharge is desired.



Patent applied for

WSW CL 7202-246A

JOY...EQUIPMENT FOR MINING



CONTINUOUS MINERS, MOBILE LOADERS, SHUTTLE CARS, COAL CUTTERS, CUTTING MACHINE TRUCKS, COAL DRILLS, CONVEYORS, TIMBER SETTERS, SHUTTLE CAR ELEVATORS, BELT FEEDERS, FANS, BITS, PORTABLE BLOWERS, COMPRESSORS, ROCK DRILLS, HOISTS, CORE DRILLS



All Joy coal mining equipment, including the new 18-SC, is available with AC or DC.

Removing overburden from diatomaceous earth



CAT DW20-No. 456 RIG PROVES BEST

Here in Basalt, Nevada, the Dicalite Department of Great Lakes Carbon Corp. has been mining diatomaceous earth since 1945. Thick layers of gravel, clay and lime overburden are removed to get at layers of the diatomaceous material below.

Quarry Superintendent Joseph Marinelli says: "Our DW20 (Series E) hauls larger loads faster. We especially like the LOWBOWL Scraper. It loads easier and cuts a wide enough swath for the push tractors (D8s) to fit into. The DW20 handles well—and another feature we like is the electric starting."

Now a new DW20 (Series F) Tractor is available. It features a Super-Turbo Engine that pro-

vides 320 HP (maximum output) ... 28% torque rise ... top speed of 35.8 MPH!

The Super-Turbo incorporates a new concept in diesel engine turbocharging. Its heart is a revolutionary air induction system, unique in earth-moving machines ... and another Caterpillar first. This system allows use of more of the Turbocharger's potential than was possible before. Results: twice as much torque rise, higher horsepower, better acceleration and gradeability. But more important, faster cycles, greater production and more profit—for you.

Get the full story from your Caterpillar Dealer. Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

FIND YOUR CATERPILLAR DEALER IN THE



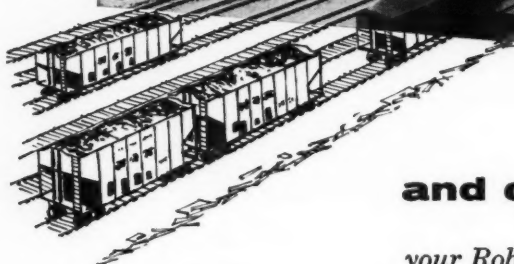
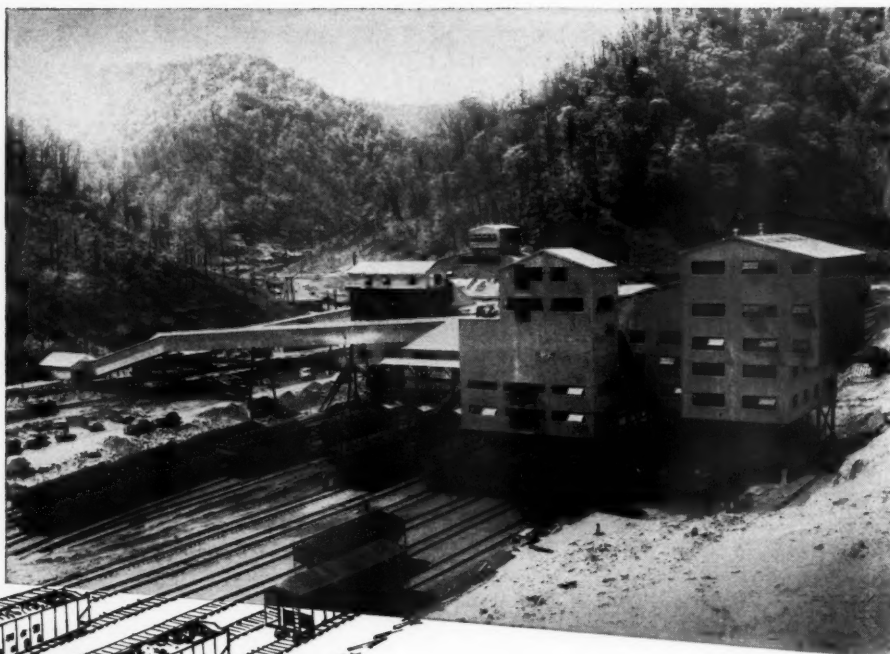
CATERPILLAR

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**WANTED—
THE HARD WORK**

Designed, Engineered and Built

to help you increase sales...



and cut operating costs

your Roberts & Schaefer Plant

You get a two-fold return on your investment in a Roberts & Schaefer coal cleaning plant.

First, a better prepared coal that will help you increase sales by satisfying the exacting needs of the markets you serve. Second, the economy of efficient operation in a modern plant specifically engineered to provide the capacity and flexibility you need.

You can be *sure* of the complete service you want from Roberts & Schaefer. Initial process studies—structural, mechanical and electrical design—installation and construction.

Call the R&S office near you when you want to discuss plans for a new plant or modernization of your present operations.



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Here's Why Bucyrus-Erie Dragline Buckets **STRIP FASTER... LAST LONGER**

Bucyrus-Erie dragline buckets are lighter and stronger because they are made with a specially-developed steel alloy called BECOLOY. It has a tough, fibrous structure that withstands shocks of great force . . . has high resistance to abrasion, high load-carrying strength!

BUCYRUS-ERIE buckets are balanced to carry loads smoothly without bobbing and spilling. Your operators can swing through each cycle faster to increase stripping production and profits.

This Model 1250-B uses a 33-cu. yd. bucket on a 200-ft. boom in stripping operations at Hanover, Pennsylvania. Machine is owned by Pennweir Construction Company, a subsidiary of Weirton Construction Co., Weirton, Pa.

Bucyrus-Erie buckets have BECOLOY in teeth, bucket lip, arch, clevis plate, and chains—the high wear parts of your dragline bucket!

FIND OUT NOW how you can increase both your production and profit with a new Bucyrus-Erie dragline bucket. They're available in light, medium, and heavy-duty types, solid or perforated. Call or write your nearest distributor today. Let him help you choose the right bucket to give your dragline extra output ability. Bucyrus-Erie Company, South Milwaukee, Wis.

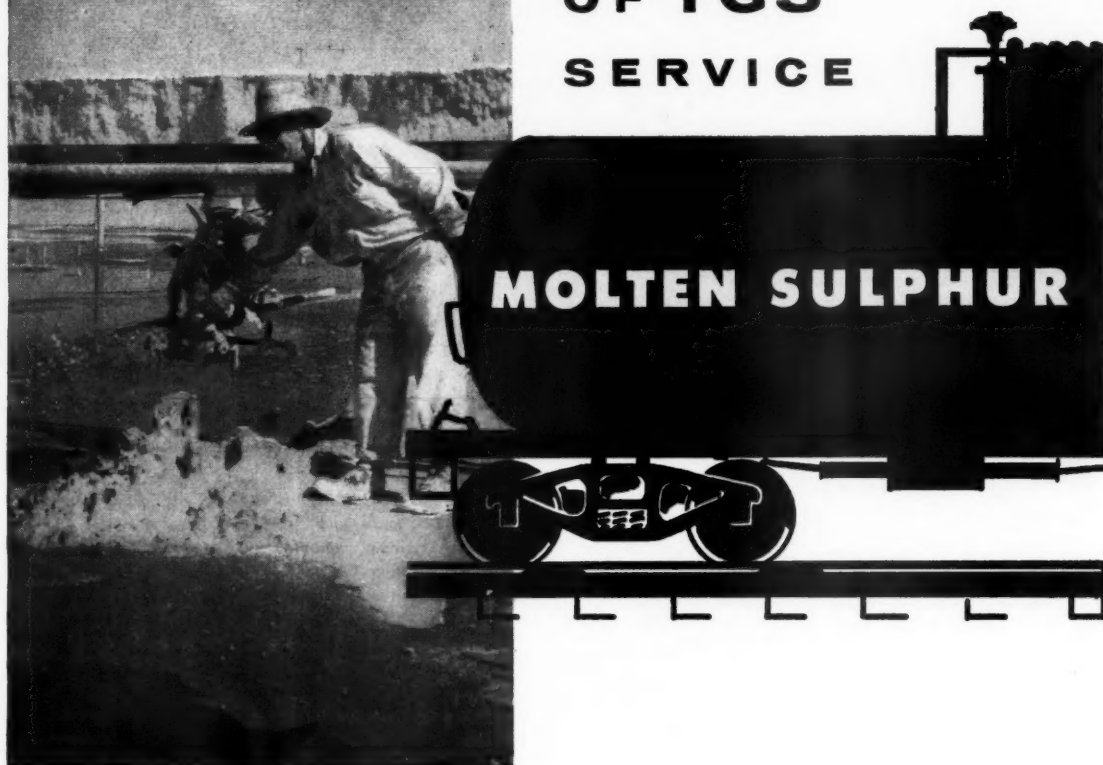
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BECOLOY *makes the difference!*



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We are now equipped to ship Molten Sulphur in tank car lots to any point in the United States or Canada.

Advantages? No contamination . . . no wind or water losses . . . cheap unloading . . . cheap melting cost . . . ready to use.

We shall be glad to discuss this new shipping service in connection with your requirements.



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Sulphur Producing Units

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Moss Bluff, Texas

Spindletop, Texas
Worland, Wyoming



Yieldable Arches GIVE when the "squeeze" is on

Heavy or shifting ground around a mine opening always needs some form of support, to give the overburden a chance to settle naturally into a pressure arch. Mining men have found that the best type of support is one which will yield slowly to the pressures until the natural arch is formed; rigid sets simply cannot stand up under the squeeze of the dynamic forces.

HOLDS FAST UNDER NORMAL LOADS

Bethlehem's Yieldable Arch works on a principle of sliding joints, which are formed by the lapping of one U-shaped segmental steel section over another as shown in the illus-

tration. Husky U-bolt clamps are installed in pairs over the lapped joints, and drawn up tightly enough to hold fast under normal loads. As pressures bear down, however, the arch yields, a little at a time.

PRESERVES MINE SAFETY

The more the Yieldable Arch "gives," the more the stress is transferred to the surrounding material. Eventually, equilibrium is reached and the Yieldable Arch stands pat, its structural integrity maintained and mine safety preserved. That is why you will hear it said that the yielding feature of the Arch is more important than its physical strength.

The Yieldable Arch can only be highlighted here, of course; there is much more you will want to know. Its ease of installation, for example, and its high degree of recoverability. You'll be interested too, in knowing, that many Yieldable Arch installations have paid for themselves in months! A Bethlehem engineer will gladly discuss the full story in terms of your own special problems. Just write to the address below.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL



Now a proved DROP BOTTOM CAR SPOTTER that will give you Dependable Performance!



Here is the simple S-D "DBS" Hydraulic Car Spotter shown with Sanford-Day Power Unit.

SANFORD-DAY
KNOXVILLE, TENNESSEE

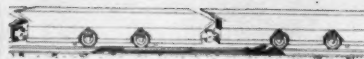
After several years of development and testing, Sanford-Day engineers have found the successful design in a drop bottom car SPOTTER that offers you dependable performance for far greater efficiency where fast-rate loading is desired at loading points. This new, but proved, spotter is the S-D "DBS" Hydraulic Car Spotter. It completes our line of S-D Spotters and S-D "Brownie" Hoists for every requirement, including S-D Hydraulic Car Spotters for Rotary Dump Cars and cars of all designs. You are going to like these S-D Spotters for their consistent effectiveness and dependability! Write us today noting your particular requirement and let us help you fit the correct SPOTTER or HOIST to your needs. Sanford-Day Iron Works, Inc., P. O. Box 1511, Knoxville, Tenn., USA.

S-D "Brownie" Hoist-and-Retriever Combination

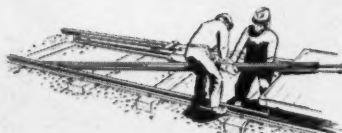


Where loading conditions do not require a hydraulic car spotter, the S-D "Brownie" HKD Hoist-and-Retriever Combination is the efficient method of moving cars by loading points.

S-D "DBS" SPOTTER effectively moves trips without damaging doors because pushing dogs operate outside door compartments!



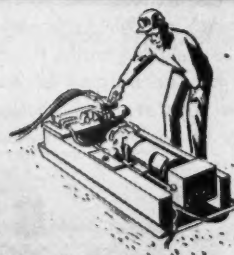
S-D "DBS" SPOTTER is the most portable spotter available. Track unit is in two sections, each 1200 lbs. and only 18 feet long.



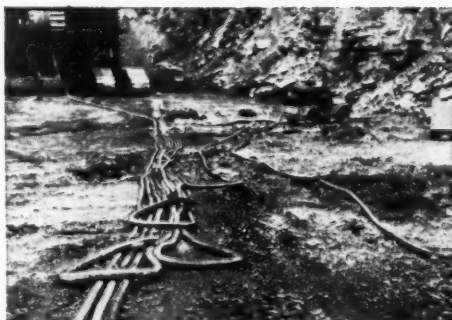
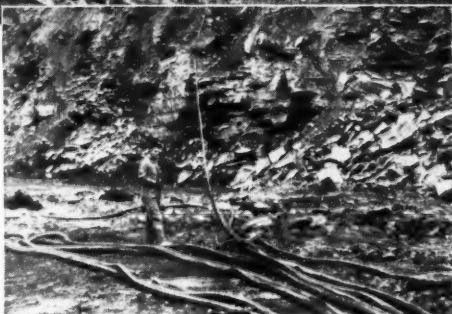
S-D "DBS" SPOTTER offers you ONE STANDARD SPOTTER for cars from less than 10 feet in length to over 30 feet!



S-D "DBS" SPOTTER Power Unit is specially designed with hydraulic controls located on the power unit itself in one panel for convenient and easy servicing! No hydraulic control valves are located on track unit!



GENERAL CABLE SUPER SERVICE PORTABLE POWER CABLE



KEEPS THIS 2900-TON SHOVEL ON THE JOB

Simco-Peabody Coal Company's mammoth Marion Type 5760 shovel, shown in operation at Coshocton, Ohio, proves once again that General Cable's Super Service Portable Power and Mining Cable can really take it under severe operating conditions. All Super Service cables have an extra-heavy-duty, mold-vulcanized *Supertuf* neoprene sheath that offers unequalled resistance to mechanical abuse, weathering, flame, oils, acids, and alkalis.

Cable that can stand up to this sort of treatment is a necessity wherever service interruptions can be costly. There's a complete line of General Cable portable power cables from 600V to 15KV, all constructed to keep your equipment on the job when the going is tough. Contact the General Cable Specialist at your nearest General Cable Sales Office and Distributing Center for complete information.

GENERAL CABLE CORPORATION, 420 Lexington Ave., New York 17
Offices and Distributing Centers Coast-to-Coast



for quality and service...specify **GENERAL CABLE**



***"Euclids give us good service
with low maintenance and keep our
hauling costs at rock bottom"***



LOUISVILLE CEMENT COMPANY, SPEED, INDIANA

Six 22-ton Euclid Rear-Dumps are hauling mortar stone, Portland cement stone and overburden at the Speed, Indiana, quarry of Louisville Cement Company. Working an 8 hour shift, three of these "Eucs" handle 400 tons per hour on hauls ranging from 1000 to 3000 feet. The wide bodies with struck capacity of 15 yards are loaded by a 4½ yd. shovel in four passes. Two other units are loaded by a 2½ yd. shovel. With loaded speeds up to 30 mph, they average 80 tons per hour on a 2 mile one-way haul. In addition, three of these "Eucs" work a second shift hauling overburden.

Louisville Cement Co., like hundreds of mine and quarry operators, has found that Euclid equipment moves more tons at lowest operating and maintenance cost. Dependable Euclid performance is the result of advanced engineering, rugged construction and almost 25 years experience with off-highway haulers.

To be sure you have the most economical hauling equipment, get a production and cost estimate from your Euclid dealer on the model best suited to your work — you'll find there are a lot of reasons why ***Euclids are your best investment.***

EUCLID DIVISION GENERAL MOTORS CORPORATION, Cleveland 17, Ohio



EUCLID EQUIPMENT

FOR MOVING EARTH, ROCK, COAL AND ORE



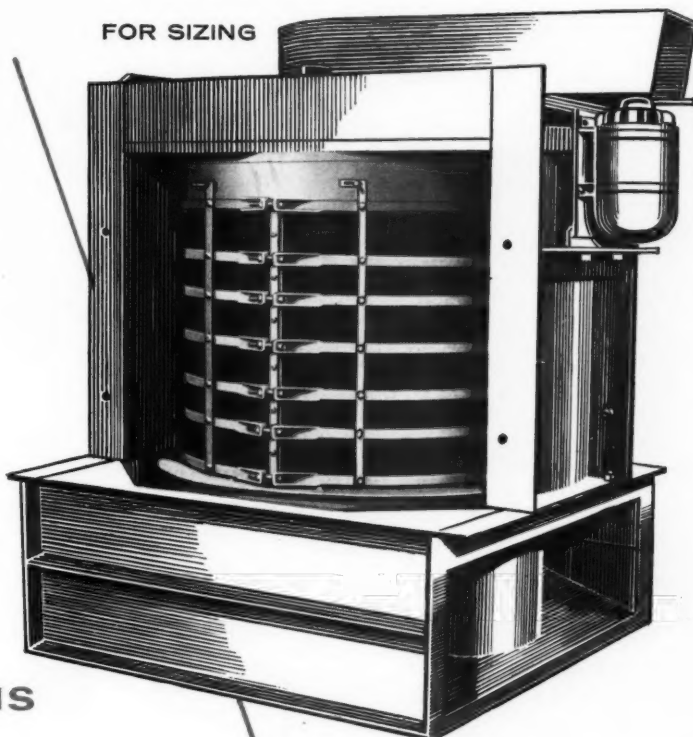
FOR DEWATERING



FOR SIZING



FOR DEDUSTING



SYMONS® V-SCREENS

are your best bet for
efficient, economical coal preparation

The SYMONS V-SCREEN combines centrifugal force with gravity to do a better screening job in the finer meshes, from 8 to 80 mesh—make sharper separations—and give you a much dryer product with less degradation than other mechanical dewatering methods. It will reduce surface moisture by at least 50%, even on fine coals . . . requires only 5 hp to operate under full load . . . and saves you money on thermal drying cost.

The capacity of the Symons V-Screen is over twice that of a conventional type vibrating screen, per square foot. In addition, its exclusive screening principle gives extremely long screen cloth life.

... the only
vibrating screen that
does not depend on
gravity alone to size
or dewater coal

*Write for your copy of Bulletin 243, which
gives the full story on Symons V-Screens.*

SYMONS . . . a registered Nordberg trademark known throughout the world

NORDBERG MFG. CO.
Milwaukee 1, Wisconsin

NORDBERG

© 1958, N.M.Co.

S-358

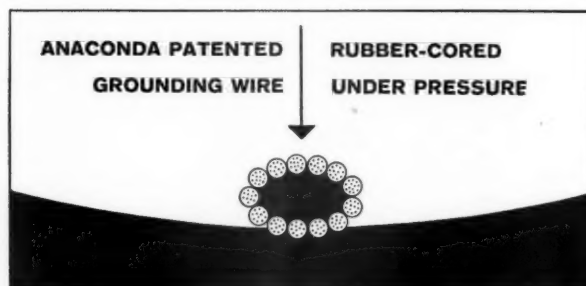
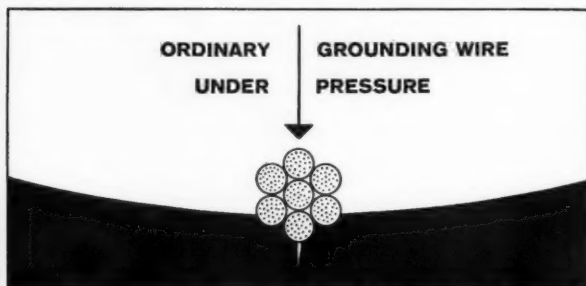


ATLANTA • CLEVELAND • DALLAS • DULUTH • HOUSTON • KANSAS CITY • MINNEAPOLIS • NEW ORLEANS • NEW YORK • ST. LOUIS
SAN FRANCISCO • TAMPA • WASHINGTON • TORONTO • VANCOUVER • GENEVA • JOHANNESBURG • LONDON • MEXICO, D. F.



IN-USE SITUATIONS LIKE THE ONE SHOWN HERE prove why Anaconda Shovel Cable with its patented rubber-cored grounding wire outlasts ordinary cable. Under pressure, Anaconda's exclusive rubber core

helps spread out the pressure—prevents internal damage. When ordinary grounding wires are subjected to the same pressure, the solid cores often cut the insulation.



Here's why Rubber-Cored Grounding Wires help Anaconda Shovel Cable last longer!

Abuse in service can seriously shorten the life of shovel cable—unless it has built-in protection, such as you find in Anaconda Shovel Cable. For grounding wire failures are one of the most common troubles. See how Anaconda engineers have solved it:

In the diagrams above you see, at left, ordinary grounding wire: a hard, compact group of stranded ropes. And it right, Anaconda patented rubber-cored grounding wire; flexible groups of stranded ropes around a soft *rubber core*.

When great pressure is applied to ordinary grounding wires, the small, hard grouping of wires bites into the

insulation. Result: cut and damaged insulation. *But* with Anaconda grounding wires:

- Anaconda's rubber core acts as a cushion and helps spread out the pressure—resisting damage to the insulation.
- Individual conductor strands are protected, too, to resist the kinks that so often are the cause of fatigue failure.
- Anaconda's grounding wires provide broader contact with the shielding making a more positive ground.

For longer lasting shovel cable, see your Anaconda distributor or the Man from Anaconda. Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.

58319



ASK YOUR **ANACONDA[®]** DISTRIBUTOR
ABOUT **SHOVEL CABLE**

The **GOODMAN** Performance Report



21782 (Patented and Patents Pending)

The GOODMAN Continuous Borer

How to make More Money mining coal

The key is the GOODMAN Continuous Borer! On solid or retreat work, the tonnages produced by the Goodman Borer are *making more money* for operators in mines throughout the coal fields. Production records in 7' mining height report these typical averages.

Crew Size	Average tons per shift	Average tons per man per shift
8	740	92.5
7	861	123.0
8	1159	143.7
8	1243	155.3
7	855	106.8
8	819	102.3

Bottom was generally good. Shuttle Cars were the initial carriers of the mined coal.

At one installation, the face cost per ton was reduced to one half the conventional mining cost even when including labor, maintenance, and materials such as roof support supplies, rock dust, bits, oil and grease. Another mine reports a Goodman Borer production of 570,000 tons without need of an overhaul.

This high tonnage production, low down-time combination is built into every Goodman Continuous Borer. It's a combination that means savings in man hours and supervisory time . . . one that makes the lower capital investment look even better.

To sum up . . . your men spend more time at the working face, produce more coal with less supervision . . . and you have less capital invested when you put a Goodman Continuous Borer to work in your mine.

You can see the Goodman Continuous Borer in action. Let us arrange it. There's no obligation.

GOODMAN

MANUFACTURING COMPANY

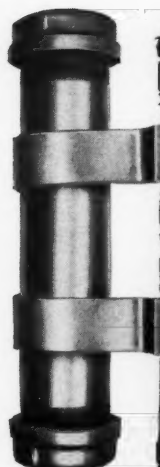
Halsted Street and 48th Place, Chicago 9, Illinois

CUTTING MACHINES • CONVEYORS • LOADERS
SHUTTLE CARS • LOCOMOTIVES • CONTINUOUS MINERS

Use Genuine Goodman Replacement Parts

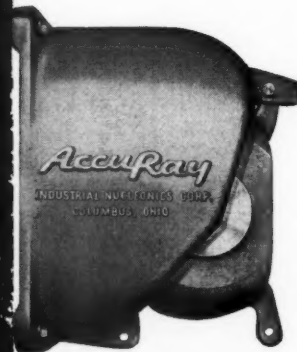
AccuRay

TANK LEVEL DETECTOR- CONTROLLER



DETECTOR

AccuRay now offers another major advancement for process industries . . . the Tank Level Detector-Controller. This new unit offers outstanding advantages over outdated float-level controls . . . competitive low cost, easy to install, and requires only a minimum of maintenance. Mounted externally, this unit is completely free from fouling by process material, and is readily accessible for routine maintenance. Special mounting brackets are provided. This instrument is fail-safed for either a high or low level signal.



SOURCE

Note external mounting of the unit. No part of the instrument extends into the tank or vessel.

The AccuRay Tank Level Detector-Controller can be used in two ways. It can be installed horizontally to provide a relay closure signal when the level rises above or falls below the level of the detector; or it can be installed vertically so that both a high level and a low level signal can be provided from one instrument. Accuracies can be maintained to plus or minus $\frac{1}{16}$ ". The radiation source is installed either opposite the detector on the tank, or across a chord of the tank. The design of the source housing provides more than adequate shielding. Design of the instrument is in accordance with accepted standards for both explosion-proof and weatherproof operation.

**Industrial
Nucleonics**
CORPORATION

1165 Chesapeake Ave., Columbus 12, Ohio

another
AccuRay
advancement for
process control

® AccuRay is a Registered Trademark of
Industrial Nucleonics Corporation

Please send complete details on AccuRay Tank Level Detector-Controllers.

Name _____ Title _____

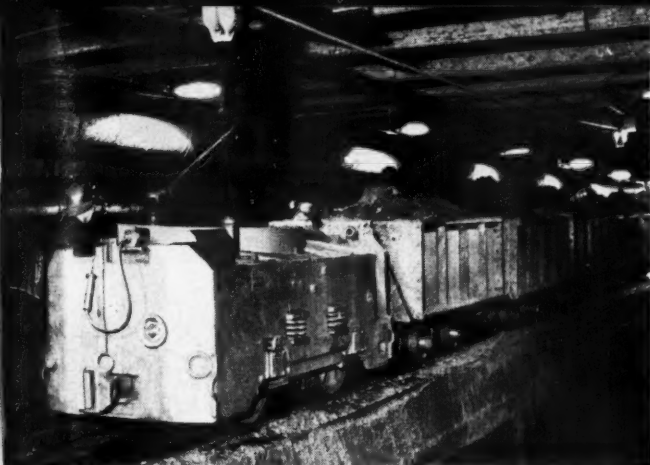
Company _____

Street _____

City _____ Zone _____ State _____

Application _____

The WORLD'S LARGEST Manufacturer of Nucleonic Industrial Process Control Systems



1. TROLLEY-CABLE REEL—Built in 4-27 ton sizes, opened or sealed types, these versatile units can do gathering jobs quickly, economically. Centrally hung motors and equalized spring suspensions help prevent rail pounding, climbing.



2. TROLLEY—Fast, powerful, safer, and easy on the track, this heavy-duty haulage locomotive is available in eleven sizes, 2 to 50 tons, low height or standard. Requires little maintenance, is of sturdy, rugged construction.



3. STORAGE BATTERY—In sizes from 1½ to 30 tons, this type unit gives highly reliable, efficient, safer service for operations where trolley wires are not feasible. Battery eliminates stand-by losses, delays due to power failures.



4. DIESEL-ELECTRIC—G-E's powerful diesel-electrics are available in eight standard sizes, 25 to 100 tons... are ideal for surface haulage and switching operations. Electric drive gives them long life, dependability.

A General Electric locomotive matched to your needs gives you fast, efficient, low-cost mine haulage

Whatever your mine haulage or gathering requirements, there's a General Electric locomotive that will suit your needs. Whether for underground or surface haulage, a G-E straight-electric or diesel-electric locomotive can haul your loads faster and at reduced costs.

General Electric offers a complete standard line of sturdy, dependable industrial and mine locomotives—available in a full range of sizes, heights, widths, and track gauges. Typical of these G-E locomotives are the four types shown above.

G-E locomotives have proven their efficiency in thousands of mine and industrial applications under

extremes of moisture, temperature, dust, and track conditions. You can expect this same efficient, highly reliable performance from a G-E locomotive that is matched to your mine's requirements. High availability and low maintenance costs mean that G-E locomotives can do your haulage jobs better... faster... more economically.

FOR MORE INFORMATION about G-E industrial and mine locomotives, or for a survey of your particular haulage needs—without cost or obligation—contact your nearest G-E Apparatus Sales Office. General Electric Company, Locomotive and Car Equipment Department, Erie, Pa.

120-106

Progress Is Our Most Important Product

GENERAL  ELECTRIC



Reg., U.S.
and
foreign
Pat. Offices

PATTIN expansion shells are
available and serviced exclusive-

In Western States

ly through Colorado Fuel and
Iron Corporation, Denver, Colo-
rado. Western mining companies
may contact them direct for in-
formation and consultation.



Most mines can Roof Bolt **Effectively and Profitably . . .**

WHILE each mine may be different in physical characteristics, in method of operation or types of equipment used—all mines have one problem in common—the problem of keeping the roof in place.

Hundreds of mines, with all different kinds of roofs, have proved that roof bolting is the best form of roof control. They have also found that bolting leads to increased safety, better ventilation and greater production efficiency. Roof bolting offers so many profitable production advantages it justifies any mine, now using conventional timbering methods, making comparative roof support tests. Bolting tests can be made at very little cost.

To be as effective as possible—roof bolting calls for thorough knowledge of the roof strata—well planned bolting patterns and cycles—proper selection of bolts and shells—and adequate supply and service program. Being "The Pioneer in Roof Bolting"—PATTIN MFG. COMPANY, staffed with experienced roof bolting, mining engineers, is capable of meeting every requirement for quality products and service. Your phone call or letter will get immediate attention.

Shown above is the outstanding PATTIN style D-1 expansion shell. Samples of the "D-1" or "D-2" shells will be furnished upon request.

PATTIN

"69th Year"

MANUFACTURING COMPANY
MARIETTA, OHIO

USS American Tiger Brand Wire Rope . . . on the job



Lifts 18 tons at a bite . . . works 24 hours a day

There's no rest for the USS* Tiger Brand Wire Rope on this big shovel. It works continuously during the iron ore season and is subject to heavy loads, abrasion and fatigue.

Not all shovel ropes are suitable for all service requirements. Shovels vary as well as digging conditions. Therefore, shovel ropes must possess greater strength, greater abrasion and fatigue

resistance. Tiger Brand* Wire Rope is designed specially for these applications to give the best possible service.

To help you select the best wire rope for your equipment, call in the Tiger Brand Wire Rope Specialist. He can frequently save you money by recommending a better rope for the job. American Steel & Wire, Rockefeller Building, Cleveland 13, Ohio.

American Steel & Wire
Division of



United States Steel

*TRADEMARK

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors • Tennessee Coal & Iron Division, Fairfield, Ala., Southern Distributors
United States Steel Export Company, Distributors Abroad



NC-1
MINE CAR
BUCKS



NATIONAL
CUSHIONING
DEVICES



WILLISON
AUTOMATIC
COUPLERS



NACO STEEL

*7 years and 460 cars later
Olga Coal Company
still 100%*

NATIONAL-EQUIPPED



Photo: Enterprise Wheel
& Car Corp.

In 1951 Olga Coal Company bought 300 coal cars equipped with National NC-1 Trucks, National rubber cushioning devices, Willison Automatic Couplers and Naco Steel Wheels.

Based on experience with the 300 original cars, Olga Coal purchased an additional 120 cars. And now Olga Coal has placed a third order for 40 more cars. This brings Olga's modern fleet up to 460 units—all 100% National-equipped.

This is typical of the swing to National-equipped mine cars—for safety . . . for longer life and lower maintenance . . . for lower per-ton mining costs.

NATIONAL MALLEABLE CASTINGS COMPANY
Established 1868 AND STEEL Cleveland 6, Ohio

WILLISON AUTOMATIC COUPLERS • RUBBER CUSHIONED UNITS • NACO STEEL LINKS
and SWIVEL HITCHINGS • MINE AND INDUSTRIAL CAR TRUCKS • NACO STEEL WHEELS

CANADIAN SUBSIDIARY *National Malleable and Steel Castings Company*
of Canada, Ltd. • 128 Simcoe St. • Toronto 1, Ontario

"Not merely to sell; but to serve . . . not only to make good steel products; but to make them still better . . . not only to fulfill today's requirements; but to anticipate tomorrow's—these are the principles that constantly guide CF&I."



G. F. Franz
President

Grinding Mill Bulletin #2

This ad is directed to those grinding mill operators who are interested in increasing the efficiency and production capacity of their ball mills. It is presented by CF&I—in line with our policy "*not merely to sell; but to serve*"—in the hopes that it will add some new information on grinding procedures.

First Things First—Determine Best One Size Ball Makeup Charge

In the first article of this series, it was shown that determining the optimum size assortment of grinding balls for a makeup charge is a practical means of improving mill operation. Before an attempt is made, however, to work out a ration makeup charge, the best makeup charge of one size ball should be established.

Factors Determining Correct Ball Size Choice

Ball . . . 1) Specific Gravity (affected by voids in the ball); . . . 2) Shape; . . . 3) Homogeneity; . . . 4) Relative Cost of balls by diameter

Mill . . . 1) Inside Diameter; . . . 2) Speed (peripheral speed rather than percent of critical speed)

Manner of Operation (assuming one-stage grinding only) . . .

1) Open or Closed Circuit (percent circulating load of closed circuit); . . . 2) Mill Pulp Density (specific gravity of pulp constituents)

Feed Material . . . 1) Size Structure of Mill Feed; . . . 2) Desired Particle Reduction; . . . 3) Character of Ore, i.e. (a) Specific gravity of gangue and of mineral or minerals, and (b) Grindability characteristics (comminution to crystal sizes; comminution through crystal sizes; sliming characteristics)

Ball Makeup Charge of One Size, for a New Mill

Use all the tools at hand to determine the best one size ball makeup charge: laboratory tests of feed material, mathematical formulae, and recommendations from ball mill and grinding ball manufacturers. One's own experience, of course, is invaluable. Full confidence cannot be placed in mathematical formulae for they may not accurately take into account all the factors affecting the not-fully-understood, complex mechanics of ball mill grinding. Tests made with laboratory-size equipment can indicate grindability of ore, but such scale-size work has its limitations in that the ratio between mill diameter, mill peripheral speed, ball diameter and particle size obtained in laboratory is not the ratio that exists in the full-scale operation.

Character of Ore—So IMPORTANT!

When a new mining property is being developed, the ore body is often not accessible; so that sampling will not indicate all the types of ore that will eventually be encountered. It is important that the comminution problem of the various ores to be encountered be studied in terms of the subsequent metallurgical processes, both physical

and chemical. The degree to which the ores will be blended before entering the ball mill should be taken into consideration.

If no blending or poor blending is anticipated, the most difficult grinding ore should be given the most weight in determining ball size, although this size may be too large for the softer ores.

Effect of Ball Size

Either too large or too small a ball size addition will result in decreased mill throughput and increased power consumption per ton of ore ground for ball mill operations in closed circuit. Under-size balls haven't the impact to break the larger particles effectively, adversely affecting subsequent mineral liberation. Over-size grinding ball addition results in the seasoned charge of fewer balls offering less surface for attrition grinding, thus giving too coarse a grind for efficient mineral liberation. The optimum one size ball addition is a "happy medium" between these two conditions.

The penalty for the use of too small a size ball addition is generally considered greater than for using too large a size ball, so the tendency is to favor the larger size.

CF&I grinding balls are available in diameters from $\frac{3}{4}$ " to 5", and are forged from special analysis steel. They are carefully inspected throughout production and immediately before shipment to make certain they have no surface pits, circumferential ridges or other surface unevenness. They are specified by many leading mill operators. Your nearest CF&I sales representative will be glad to give you complete details.

Indications of wrong size balls used in makeup charge in an operating mill will be discussed in the next article in this series on ball rationing.

For a reprint of the article on which this ad is based, please write on your company letterhead to: Mining Supply Department, The Colorado Fuel and Iron Corporation, P. O. Box 1920, Denver, Colorado.

OTHER CF&I STEEL PRODUCTS FOR THE MINING INDUSTRY

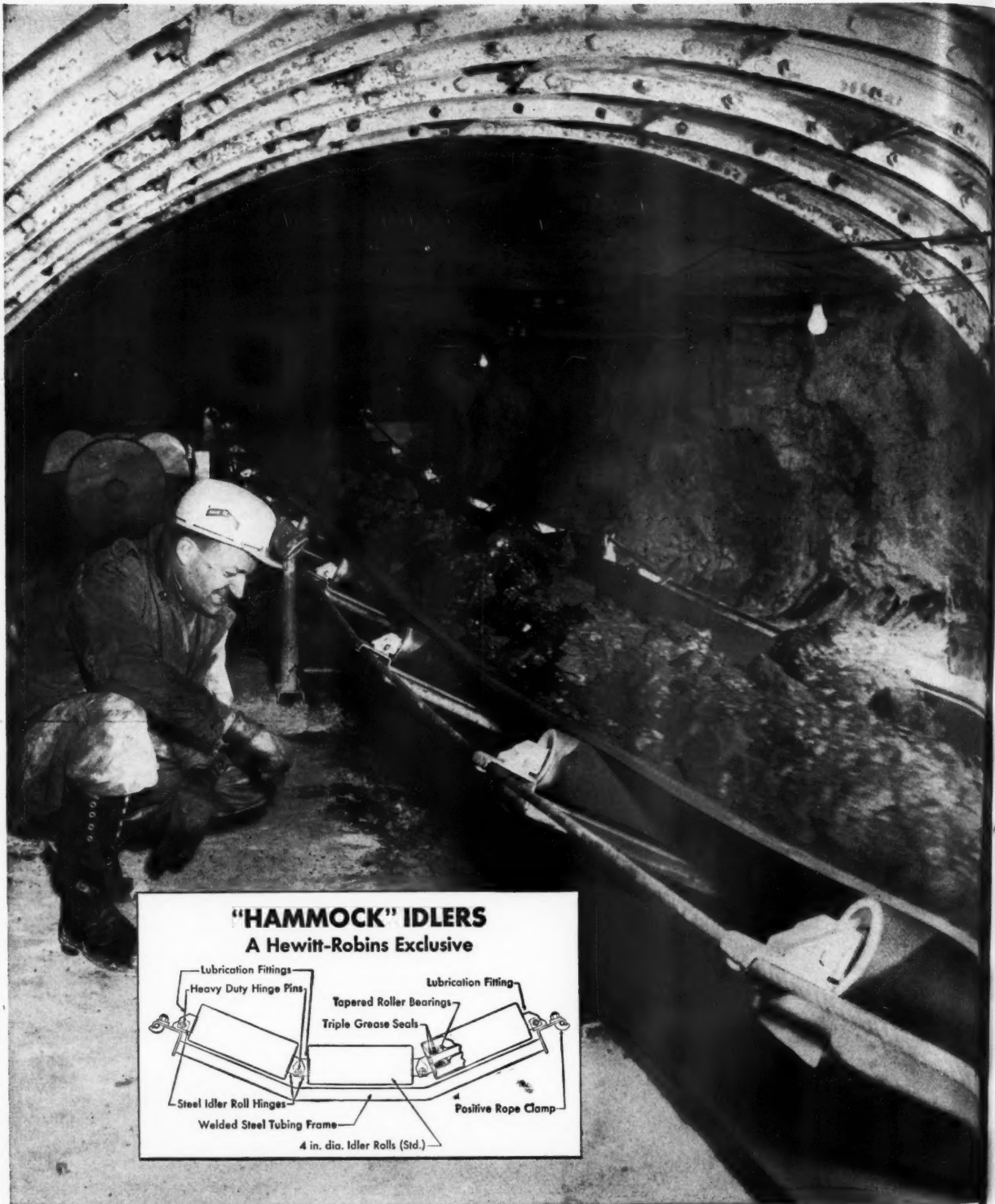
CF&I Grinding Rods • CF&I Grader Blades • CF&I Industrial Screens
CF&I Mine Rail and Accessories • Wickwire Rope • CF&I Rock Bolts



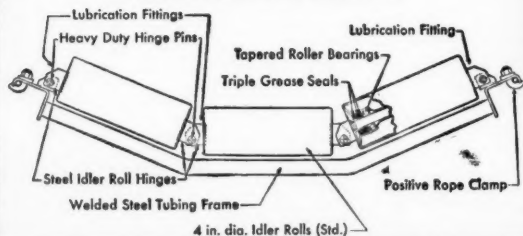
FORGED STEEL GRINDING BALLS
THE COLORADO FUEL AND IRON CORPORATION

5823

Albuquerque • Amarillo • Atlanta • Billings • Boise • Boston • Buffalo • Butte • Chicago • Denver • Detroit • El Paso • Ft. Worth • Houston
Kansas City • Lincoln (Neb.) • Los Angeles • New Orleans • New York • Oakland • Oklahoma City • Philadelphia • Phoenix • Portland
Pueblo • Salt Lake City • San Francisco • San Leandro • Seattle • Spokane • Wichita



"HAMMOCK" IDLERS A Hewitt-Robins Exclusive



Self-contained, with its own anchor stands, the "Rope Stringer" conveyor can be used with any head or tail equipment.



"ROPE STRINGER"

The last word in low-cost, high-capacity, easy-to-handle conveyors

See how Hewitt-Robins has made the "Rope Stringer" conveyor easy to handle, economical to buy, simple to install and operate!

The "Rope Stringer" conveyor consists of simple support and anchor stands, the supporting wire ropes, Hewitt-Robins exclusive "Hammock" idlers, and Hewitt-Robins conveyor belt. The conveyor can be extended by a small crew and can be dismantled and set up in a new location in a fraction of the time required by rigid conveyors!

With this "Rope Stringer" conveyor, spillage is greatly reduced. Thanks to the catenary action of the "Hammock" idlers, spillage is less than one third that of a rigid deck conveyor. And safety is increased, too—the "Hammock" idler and frame assembly can be quickly removed or replaced as a unit, with the belt in place!

"Rope Stringer" Conveyor Advantages

Valuable features incorporated into this new Hewitt-Robins rope conveyor are made possible by the use of flexible supports and a unique "Hammock" idler arrangement. These give several major advantages:

Easy Installation

- Idlers are quickly skidded into position between belt strands.
- Trougher spacing is readily varied to suit conditions.
- Anchor stand assemblies can be bottom or roof mounted.

Better Operation

- Minimum spillage—load and belt are continuously centered by catenary action of hinged "Hammock" idlers.
- Longer belt life through cushioning action of "Hammock" idlers.
- Rounded idler frame protects return belt at points of severe dip.
- No training idlers required.
- Level travel assured because either leg of stand can be adjusted for height.

Provision for Relubrication

- Triple-sealed bearings can be easily relubricated.

Simple, Sturdy Construction

- Strong, welded tube spreader frame.
- Substantial, long-life link and hinge design idler rolls.
- 4, 5, or 6 in. idler rolls available.
- Removable link pin for idler roll replacement.

Maximum Safety

- Idler rolls and frame positioned as a unit.
- Double spreader prevents idler rolls from dropping onto return belt.

See for yourself how this new "Rope Stringer" conveyor can pay for itself promptly in your operations! Only Hewitt-Robins provides all the advantages of the "Rope Stringer" conveyor—complete with the H-R belt of your choice! For further details, consult your Hewitt-Robins representative.

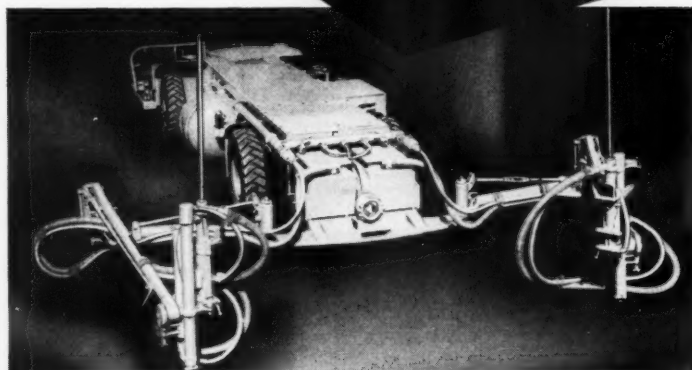


HEWITT-ROBINS

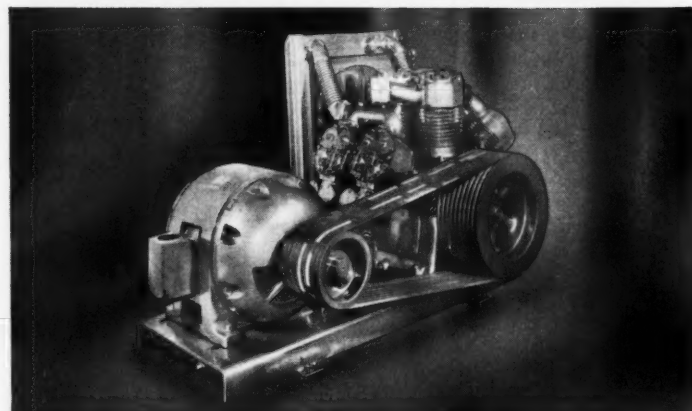
THE NAME THAT MEANS EVERYTHING IN BULK MATERIALS HANDLING SYSTEMS...
CONVEYOR BELTING AND IDLERS • POWER TRANSMISSION DRIVES • INDUSTRIAL HOSE • VIBRATING CONVEYORS, SCREENS & SHAKEOUTS

ACME

FOR MODERN MINING PRACTICE



MODEL 275 SPRHJ "SUPER JUMBOLTER" Air articulated arms reach out 9' in front of machine. Built-in compressor insures maximum mobility and efficiency.



MODEL S-2 SEMI-STATIONARY COMPRESSOR For primary air supply up to 450 CFM delivery. Available in 50, 75 and 100 HP units.

USE ACME FOR:

Roof Bolting

Track Maintenance

Drifting & Tunnel Driving

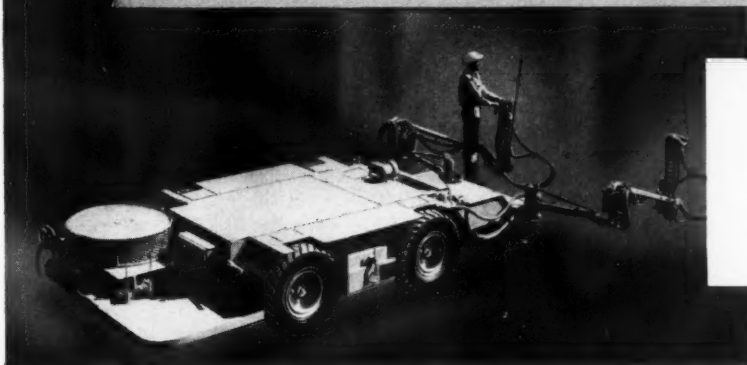
Hanger Holes

Brushing Top and Bottom

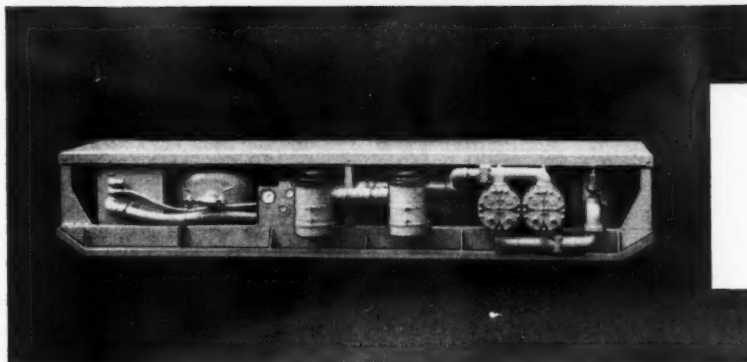


Warehouses and sales offices
Morgantown, W. Va.
Representatives in principal
mining areas.

A complete line of Portable and Semi-stationary Air Compressors and Drill Rigs



**MODEL HSJ-4WD FOUR
WHEEL DRIVE JUMBOLTER**
Each wheel an independent
driving unit. Minimum turn-
ing radius. Front platform is
hydraulically operated for
raising when necessary.



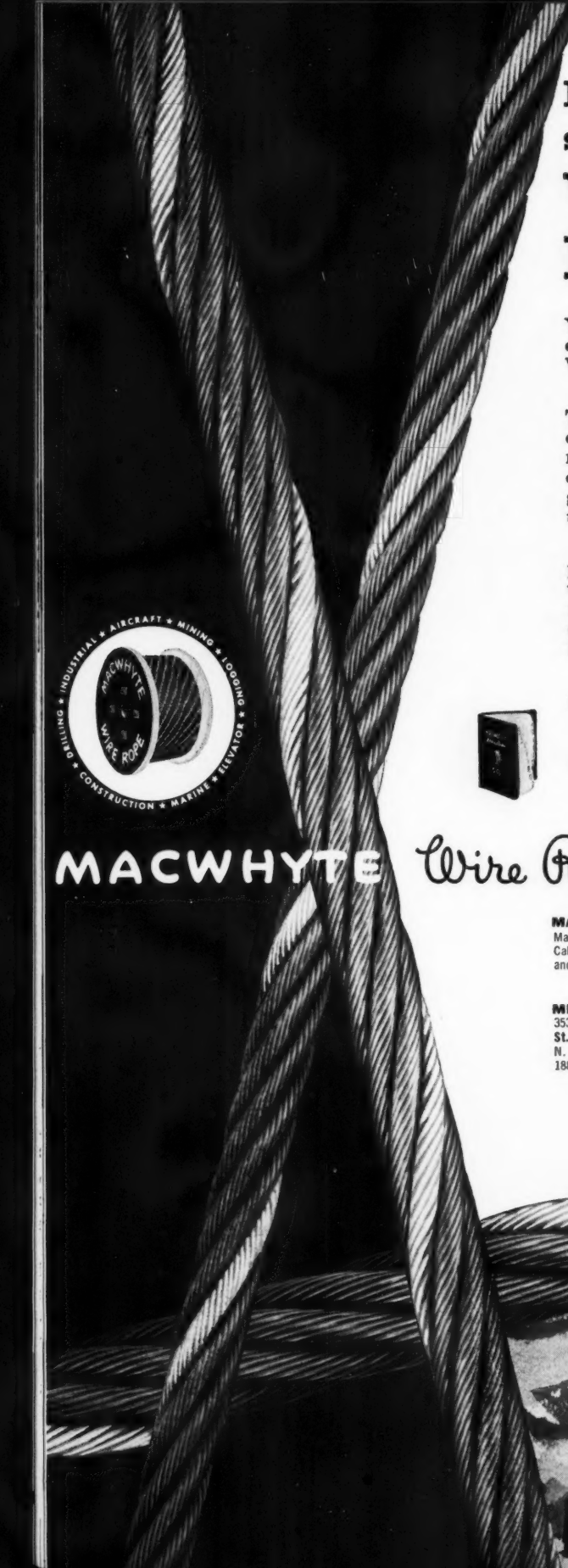
**MODEL 275-S COMPRESSOR
UNIT** Can be used as drag-
around unit or mounted on a
carriage. Variations of this
standard model are available.



MODEL 275-T COMPRESSOR
Track mounted with 3" class
drifter. Self propelled units
available with or without
cable reels. Stoper or drifter
arms may be added.

ACME MACHINERY COMPANY

WILLIAMSON, WEST VIRGINIA



How to get longer service life with **Whyte Strand Mining Ropes**

You can lengthen the service life — and lower the yearly cost—of your wire ropes by using the *correct* Whyte Strand Wire Rope for each application.

What do we mean by correct? Well — all wire rope isn't alike. The demands of dragline service are different from those on haulage ways or shaft hoisting. And there's a Whyte Strand rope specially designed to withstand the particular abuses of *each* kind of mining service. What's more, we'll be more than glad to work with you in finding which of Macwhyte's thousand-and-one ropes is the *best* for *your* kind of job.

All Macwhyte ropes are Internally Lubricated, by a special process which individually coats every wire . . . every strand . . . with a tough, tenacious lubricant coating. This increases the rope's flexibility, reduces internal wear, and provides excellent corrosion resistance. Result: Longer service life with Whyte Strand Mining Rope.

Ask your Macwhyte distributor to give you the correct wire rope specifications for use on *all* your equipment!

Write for industry's authoritative booklet on wire rope and its uses. Ask for Catalog G-16 — the *Blue Book of Wire Rope!*

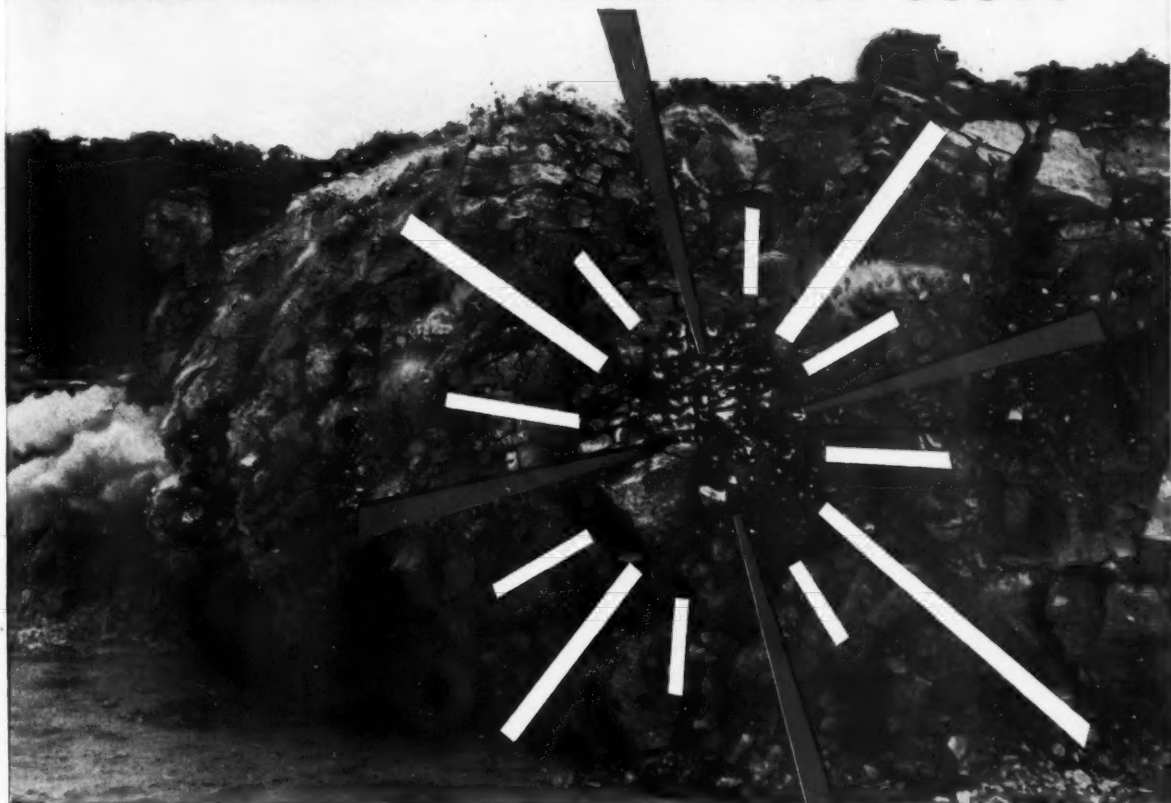


MACWHYTE *Wire Rope* COMPANY

MACWHYTE WIRE ROPE COMPANY, 2952 Fourteenth Avenue, Kenosha, Wisconsin
Manufacturers of Internally Lubricated PREformed Wire Rope, Braided Wire Rope Slings, Aircraft Cables and Assemblies, Monel Metal, Stainless Steel, Plastic Coated and Nylon Coated Wire Rope, and Wire Rope Assemblies. Special catalogs available.

MILL DEPOTS: New York 4, 35 Water St. • Pittsburgh 36, P. O. Box 10916,
353 Curry Hollow Road • Detroit 3, 75 Oakman Blvd. • Chicago 6, 228 S. Desplaines St.
St. Paul 14, 2356 Hampden Ave. • Ft. Worth 1, P. O. Box 605 • Portland 9, 1603
N. W. 14th Ave. • Seattle 4, 87 Holgate St. • San Francisco 7,
188 King St. • Los Angeles 33, 185 South Myers Street.

HOW MUCH DID THIS BLAST COST?



Explosives costs alone don't determine the value of a given blast. The explosives you use have a direct effect on the whole operation: drilling, digging, hauling and crushing.

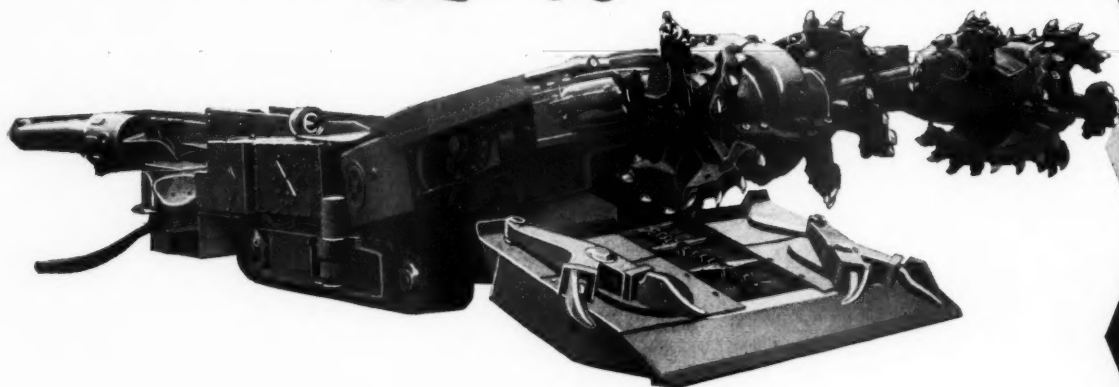
You can find out, quickly and easily, the true, complete cost on any blast by using the new, simplified computing method developed by Atlas. It's called the Blasting Cost Chart, and it's yours without cost or obligation.

Use this new method to learn your real blasting costs. It will help you plug profit leaks and come out money ahead in your blasting. Your nearest Atlas representative will show you how the chart works, and you can keep the actual figures within your own organization.



 **EXPLOSIVES
DIVISION
ATLAS
POWDER COMPANY**
WILMINGTON 99, DELAWARE
offices in principal cities

HERE'S WHY THOSE WHO KNOW PREFER THE *Lee-Norse* MINER



PATTERN CUTTING—only *Lee-Norse* has it.

CUTS MORE COAL WITH LESS POWER . . . cutters revolve and oscillate at the same time—milling the coal from the face.

CUTS A COARSE PRODUCT—FEWER FINES . . . cutter bits follow a right and left spiral direction producing a diamond pattern which breaks off in coarse cuttings.

A SIMPLE, STURDY MACHINE . . . essentially a modern loading machine on which is mounted a set of efficient cutting heads.

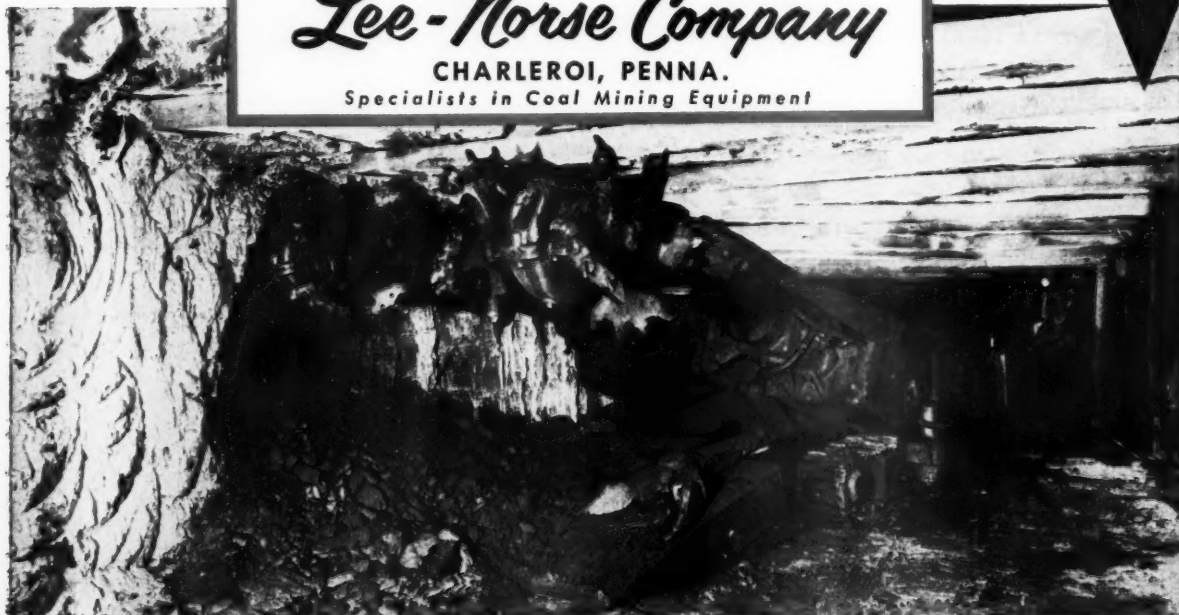
HIGHLY MANEUVERABLE—FAST TRAMMING. . . . not a “muscle-bound giant” . . . it quickly follows any variation in seam thickness.

EXCELLENT CLEAN-UP . . . improved dual gathering arms load all the coal into a flexible rear conveyor.

Lee-Norse Company

CHARLEROI, PENNA.

Specialists in Coal Mining Equipment



Roebling Presents
**THE NEWEST CONCEPT
IN WIRE ROPE**

*Herringbone**

*two
ropes in
one!*

Here is a combination that has proved itself during three years of field testing. A welcome addition to Roebling's great line of wire ropes, Royal Blue *Herringbone* is both a regular lay and lang lay wire rope!

So, in one rope you have the greater flexibility and abrasion resistance of lang lay construction *plus* regular lay's superior stability under severe operating conditions.

Preformed *Herringbone* is made of two *pairs* of lang lay strands, and two strands of regular lay which separate the two *pairs* of lang lay—all of it made of Type 1105 rope wire.

For three years *Herringbone* has been used for general hoisting, holding and

**Reg. app. for*

closing lines, shovel ropes, wagon scraper ropes and dragline ropes. Without reservation, its performance has been superior to that of any other rope used for the same jobs... even in the hands of inexperienced personnel! *Its proven capabilities clearly suggest its use for all jobs where steel core ropes are normally used.*

See your Roebling salesman for all the facts or write Wire Rope Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey. Roebling *Herringbone*, the two-in-one rope to meet the *doubly* stringent demands of today's economy.

ROEBLING

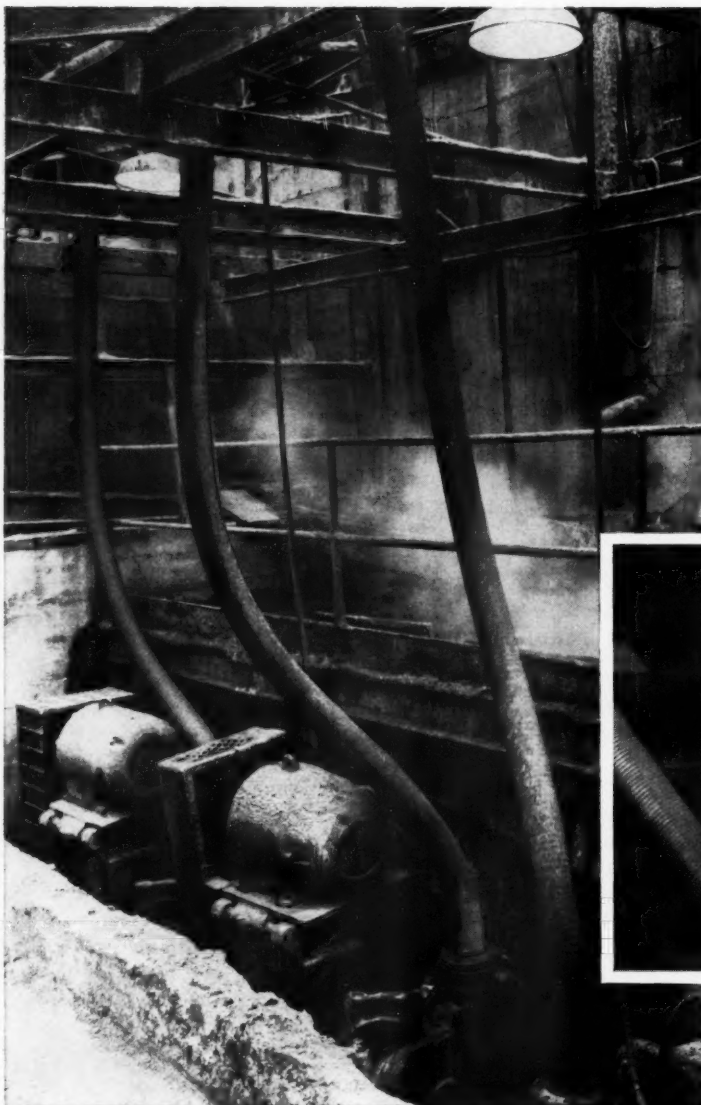


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PILOT PIPE



Abrasion in piping?

Here's how a big uranium mill solved it with "U.S." flexible rubber pipe



- Four 8" U. S. Pilot Pipes carry fine screened ore from secondary crusher storage bins. Four more pipes feed too-coarsely crushed aggregate onto a conveyor belt and back into the crusher. On both jobs, Pilot Pipe has lasted over 4 years.
- In this severe service, quenched calcined ore pulp — 50% solid — is pumped through these lengths of U. S. Pilot Pipe, from the roaster calcine pumps.

Where to get flexible piping that can stand up to severe abrasion without being chewed up?

Union Carbide's Uravan mill found the answer in U. S. Pilot® Pipe and Pinch Valves. In addition to the operations pictured above, these products handle the slurry on the 9 separate pumping stations of the counter-current decantation wash circuit, are used on the 2 booster stations between leach and tailings disposal plants and between the primary acid leach and roaster.

This pipe is specially built to handle abrasive materials, such as calcined ore, and corrosive materials, such as solutions containing sulfuric and hydrochloric acids. It is flexible, easy to install and won't build up. Its service life is longer than that of metal pipe.

U. S. Pilot Pipe and Pinch Valves are available at your local "U. S." Distributor, at any "U. S." branch, or write us at Rockefeller Center, New York 20, N. Y. In Canada: Dominion Rubber Co., Ltd.

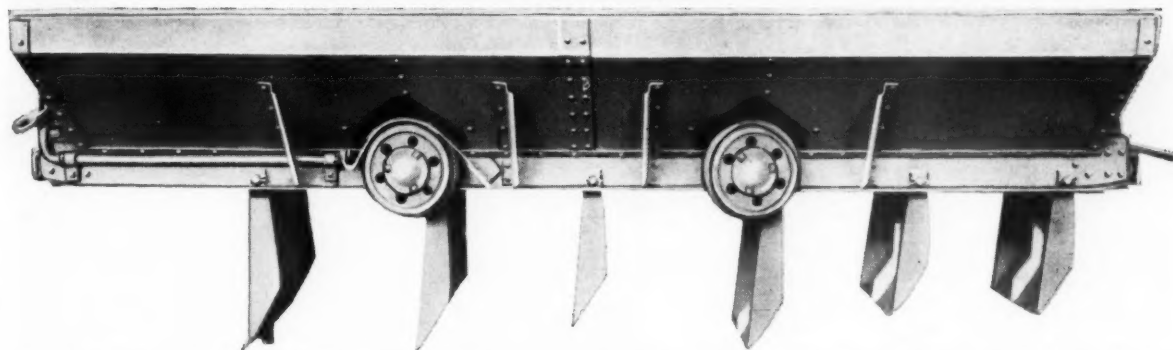


Mechanical Goods Division

United States Rubber

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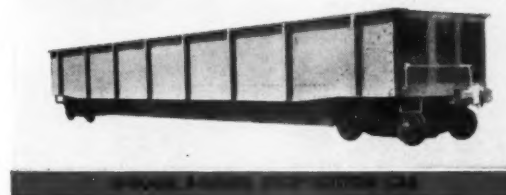
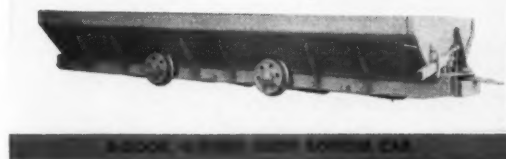
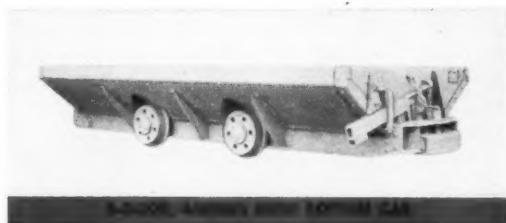
- Smoother, faster operation
- Minimum wear, year after year
- Speedy unloading with easy, positive door action
- Corrosion resistant hinge rods
- Interior fittings for greasing

ACF Automatic Drop Bottom Mine Cars are available in every capacity and type. Designed and constructed to meet specific operating needs. Welded end sill members, exclusive double action spring bumpers. Chilled Tread "Load Support" Wheels with roller bearings assure long, trouble-free service.

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PRODUCER

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Wemco-Fagergren, more than ever, is a standard in the world's major operations. It consistently gives highest recovery per dollar spent.

It maintains a world-wide reputation for dependable production—under the toughest conditions.

The investment in Wemco-Fagergren Flotation machines is sound—wherever maximum production and recovery with low costs are vital factors of operation.

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**National Mine
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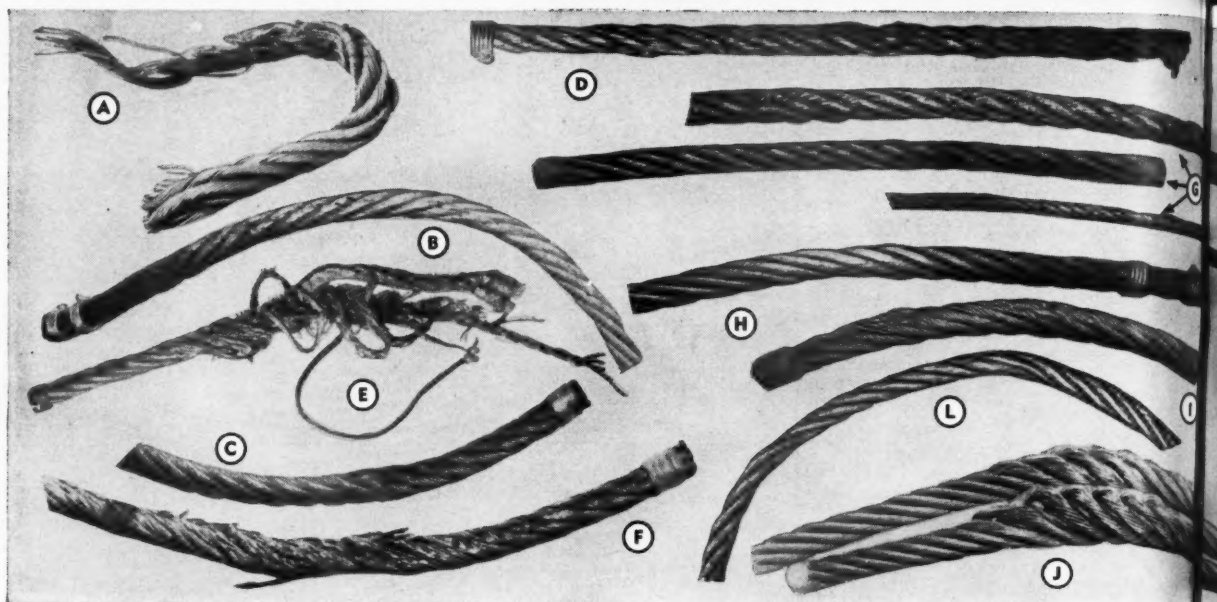


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Tuffy Wire Rope



Guard Against these Cripplers and Killers of Wire Rope

Pictured above are some of the results of wire rope abuses. They quickly ruin wire rope efficiency or end rope life abruptly, long before you have had the service you paid for. Even the best wire rope is a sitting duck for these enemies. When you avoid or minimize them, you make real gains in longer rope life, better service and greater economy. Remember, your Tuffy distributor will be glad to work with you against these and other wire rope hazards.

Here are the "case histories" of the untimely wire-rope fatalities and injuries shown in the picture:

A. Mangled in a wedge socket: Here's a result of improper socketing. It was caused by using a poorly designed or worn-out wedge socket. Failure at the dead end can damage other sections of the rope, too.

B. Rusty road to ruin: Rust—No. 1 enemy of steel—takes a heavy toll in wire rope life. An insidious, silent type of killer, rust often does irreparable damage before it's even noticed. The one-strand break shown here resulted when the rope was allowed to become rustbound through lack of lubrication. Tests show that, with other conditions ideal, properly lubricated rope has up to 10 times the life expectancy of dry rope.

C. The crushing blow: The Sunday punch for this piece of wire rope was delivered by a tractor cleat—just one of many crushing injuries caused by rope being run over or banged into by hard, sharp objects. Even the toughest wire rope is no match for this kind of mistreatment.

D. Strangled by a misfit: When the bearing surface of a sheave is too small for the rope diameter, pinching action quickly destroys the rope—especially when it's overloaded. The victim shown here was knocked out in just 1½ hours of service.

E. Apparent suicide: This rope jumped out of sheave and was soon destroyed by pulling around the shaft. Actually it was a case of sudden slack which threw the rope out of the sheave.

F. End of the line came quickly for this rope as the result of operating over a sheave that did not turn. Note the exceptionally heavy abrasion on one side of the rope. Sheaves should be checked thoroughly and often.

G. Victim of the "bends": Excessive bending of wire rope accelerates wear. Generally, more flexible ropes are used as bending stresses increase (with decrease in tread diameter of sheave or drum). If a rope is operated on a sheave too small for its bending characteristics, early failure is certain. Through an exhaustive series of bend-

ing tests, Union Wire Rope engineers have compiled data that you can use to assure getting the rope construction that will give you the longest service life. Ask about it.

H. On the "blink" from a kink: This open kink resulted from mishandling of rope. Guard against kinks by proper winding on the drum. Never pull a loop smaller. Always enlarge it, then straighten out the rope.

I.-L. Crushed and worn from "beatings on the drum": Even under normal operating conditions, drum wear gives wire rope severe punishment. This wear concentrates at the cross-over points and at the flange. Excessive drum crushing results from operating on small drums, excessive loading and poor winding. Smooth drums are not recommended. Here are typical "drum beatings":

- I. Cross-over wear.**
- J. Cross-over crushing on drum.**
- K. Drum crushing from poor winding.**
- L. Drum-crushing from small drum.**

Although drum wear cannot be eliminated, its effects can be greatly reduced. Under properly engineered procedures, two and three times the service can be obtained from the same line by improving drum conditions. Union Wire Rope engineers will help you with this problem. Get in touch with us for more information.

Tips

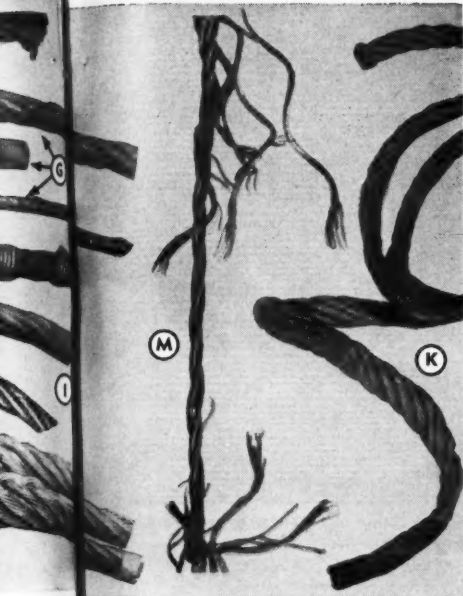
Be Sure You Use **BALANCED** Wire Rope

You hear a lot about extra strength in wire rope. There is no trick to designing wire rope with very high strength. But — there is nothing to be gained if high strength is put in to the exclusion or subordination of other qualities that are just as important as excessive strength.

For example: the life of a dragline depends on its resistance to abrasion. When it breaks, as a result of continued exceptionally hard digging in abrasive materials, the owner finds maintenance cost of the dragline increasing. Hard-drawn rope tends to act as a spring. As wear progresses, it arches over the crown of the strand. Repeated flexing of this too-strong arched wire causes early failure. So the drag rope must meet a condition where strength is not the major factor in resisting abrasion.

Every one of the Tuffy Special Purpose Ropes has a different ratio of strength to other properties necessary for longest life, most efficient operation and lowest maintenance expense. Your Union Wire Rope distributor has the BALANCED rope for every application.

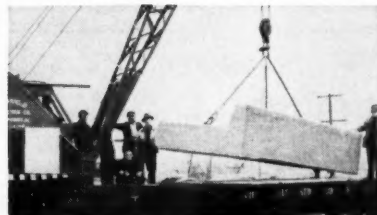
**Tuffy Special-Purpose Ropes are
tailored & BALANCED for special uses**



M. Overloaded — soon exploded: The rated capacity of a wire rope is based on the breaking strength (catalog) divided by a safety factor applicable to the type of service or use. The grade of steel, type of construction and size of the rope determine tensile strength. It must be properly related to the loads it will carry, or costly and dangerous early failures are likely to occur.

How Your Tuffy Distributor Can Help You Save Money

Condition of equipment is a big factor in longer rope life and greater economy. Your Tuffy distributor will help you check your equipment and operating conditions to make sure everything is in your favor for getting greatest service from your wire rope. Get in touch with him. And ask him to put your name on his mailing list for FREE Tuffy Educational Bulletins.



Tuffy BALANCED Slings & Hoist Lines

Top-performing team in every type of materials handling. Tuffy Slings are made of a patented, machine-braided fabric; stays extra flexible, can't be seriously hurt by knotting or kinking. Tuffy Hoist Line is a special construction of super flexibility and toughness.



Tuffy BALANCED Dozer Rope

Built to give you longer service with less downtime. 150' reels of 1/2" or 9/16" mounted on your dozers allow you to cut off worn sections without wasting good rope. Put Tuffy Dozer Rope on the job and watch costs go down!



Tuffy BALANCED Scraper Rope

It's flexible enough to withstand sharp bends, yet stiff enough to resist looping and kinking when slack. Moves more yardage per foot because it's specially built and balanced to take the beating of drum-crushing abuse.

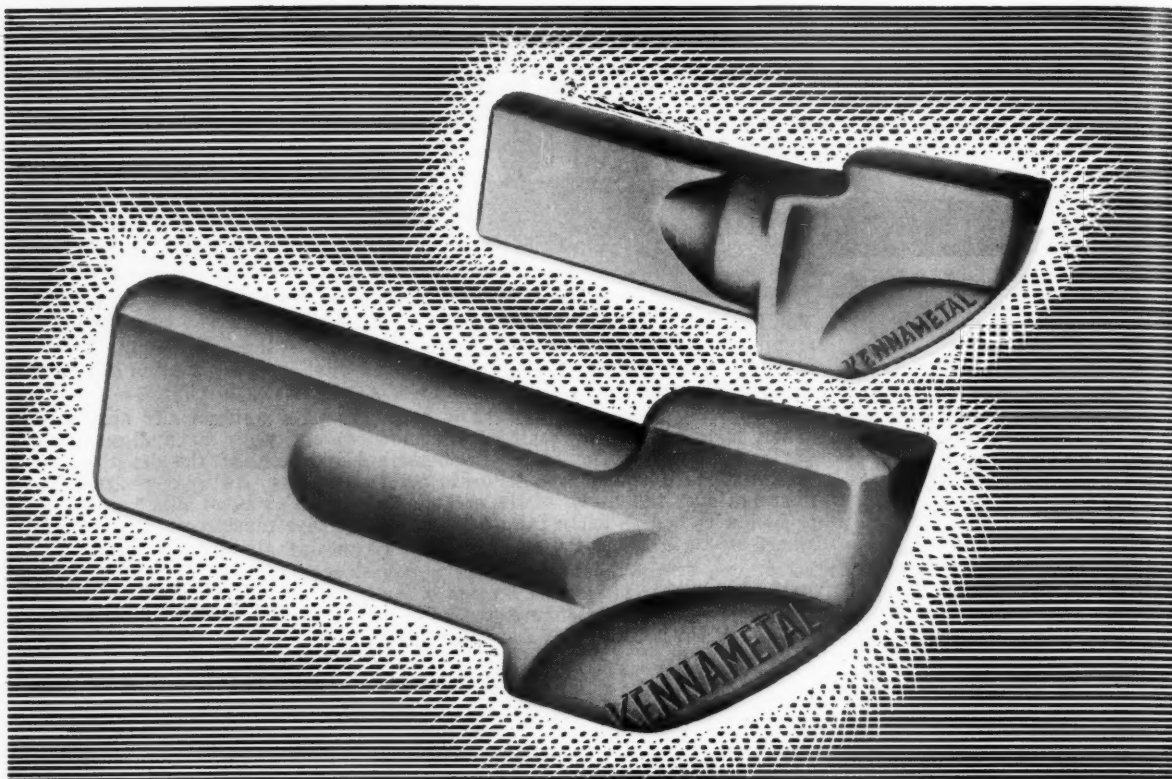


Tuffy BALANCED Dragline Rope

Made to give you maximum abrasive resistance with super flexibility. Rides smoothly on grooves; hugs the drum when casting for full load. Consistently dependable in handling any material — wet or dry dirt, sand, gravel, rock, cement or minerals.



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Specialists in high carbon wire, wire rope, braided wire fabric, stress relieved wire and strand.



Kennametal cutter bits with stronger shanks for today's higher powered mining machines.

Next time the going gets rough...

Try these two NEW Kennametal* Cutter Bits

Using standard bit blocks, the new U7B Series, shown in the foreground above, quickly and economically reduces shank breakage in hard cutting sections. Reinforcing ribs on both sides of the shank fit the center hole of most bit block designs and provide the added shank strength required to resist side thrust.

Kennametal offers the rugged U3 Series for *extreme* cutting conditions, where hard impurities are encountered frequently and maximum bit strength is required. Special Bit Blocks to fit the U3's greatly increased cross sectional area are now available.

Actual mine testing, in problem areas, has proved that both of these bits keep cutting coal where other bits fail.

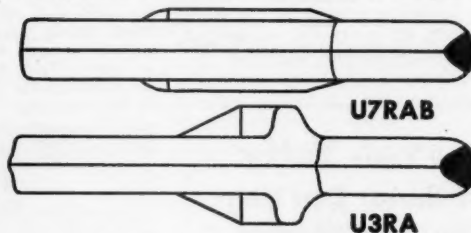
Forged from highest quality steel, the added shank cross section provides the strength required to stand up in difficult cutting areas under the high power of today's mining machines.

Get more information on the latest of "The Yellow Bits" from your Kennametal Representative. You'll find his name listed in the Classified Section of your Telephone Directory under "Mining," or write KENNAMETAL INC., Mining Tool Division, Bedford, Pennsylvania.

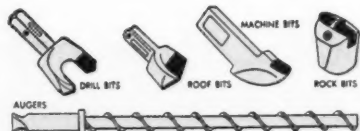
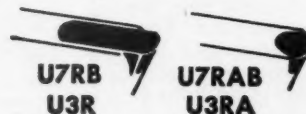
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Increased cross section provides increased strength



2 GOOD TIPS—Both Kennametal U3 and U7B Bits are available with these popular tips.



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EDITORIALS

ROBERT W. VAN EVERA, Editor

JUNE, 1958

WILL AMERICA REMAIN COMPETITIVE

The "recession of 1958" has been analyzed, discussed and written about from countless viewpoints. One of the most repeated observations is that it is unlike any previous recession because it is accompanied by continuing inflationary trends.

In this uncertain state of domestic economic affairs, Roger M. Blough, Chairman of the Board of U. S. Steel Corporation, recently spoke to the annual meeting of the Cleveland Chamber of Commerce. After giving examples of numerous items that are being imported into this country and sold at prices below our own costs of production, Mr. Blough stated that, "More than three-quarters of the purchase price of American-made products goes to pay the wages and salaries of the men and women who transform raw materials into finished products, bring the products to the market place, and sell them to consumers." He went on to make the point that "The American workman is being misled in a big way by some of his most vocal and powerful leaders. Labor's one-way philanthropists would take jobs away from our workmen and give them to workmen abroad." Is it not possible that the recession-inflation paradox may be the result of a high-level floor on American wages while foreign wage rates are set by the natural law of supply and demand?

Within our own economy it appears possible to build up the market for manufactured goods *temporarily* by increasing the number of wage dollars paid to produce those goods. This seems to have been the case in the United States during the post-war period, at a time when European producers were so busy rebuilding their industrial facilities that they were unable to turn out much merchandise. Now, the situation has changed—these foreign industries have at last conditioned themselves to mass-produce goods for the huge markets in the United States—and because their wage rates are about one-third of the American rates, they can compete successfully. Said Mr. Blough, "Sooner or later we will have to face up squarely to one undeniable fact—that America, as a nation, is costing itself out of the market."

The immense power of labor unions, which has been brought to bear in politics as well as at the bargaining table, has forced American industry to give in to all sorts of

demands, thus increasing wage costs far out of proportion to labor's productive capacity. We are just now beginning to feel the adverse effects of this folly.

But American industries won't sit idly by to watch foreign suppliers take away their business. With increased attention by management and labor to holding production costs in line—and adoption of government policies that will give the domestic producer a fair break—this country can continue to produce for the domestic market and to supply manufactured goods to the potentially vast markets abroad. To fail in this would mark the end of American leadership in the free world—and increasing numbers of loyal American workers would lose their jobs to lower-priced workers in the rest of the world.

IN GOD WE TRUST

The 1957 annual report of United States Smelting Refining and Mining Company tells another story of distress in an ailing segment of the mining industry—"Alaskan (gold dredging) operations contributed substantially to the earnings of the company . . . until two years ago but it appears they cannot contribute to earnings in the future. How long the Fairbanks and Nome operations will continue is dependent to a great extent upon costs, but it is expected that they will not continue beyond 1963 or 1964."

The trend of gold production in the United States has been downward since 1950—for the obvious reason that the price is fixed while costs of production are rising. The gold backing of our dollar is also following a downward trend—approaching the point where foreign creditors, to whom gold is the measure of freedom and prestige, may be losing confidence in the dollar.

At the same time there are reasonable indications that Russia is constantly increasing her production of gold and may be planning for the day when she can announce a fully convertible ruble. What a tidal wave that would make on the choppy sea of international economy and world opinion!

It is time to ponder the gold question—for action, or inaction, on our monetary policies could have far-reaching impact on the well being of American citizens, on this country's foreign relations and on the prestige of American industry in world trade.

With a healthy respect for the complex problems involved, we feel that the Government officials charged with monetary authority should carefully prepare and execute a plan to make an orderly return to a realistic gold-dollar ratio and to full convertibility in accordance with the property rights of Americans as guaranteed by the Constitution.

The New Mining Company

THE highly diversified industrial minerals branch of our mining industry has been growing in importance and prominence for many years; particularly during the past 15 years. A marked trend began to develop during World War II that gained momentum following the war—a trend toward a more extensive exploitation and utilization of the nation's industrial minerals. The progress attained to date cannot be attributed merely to one, or a few, factors because of the over-all complexity of the economic structure involved. However, one of the factors—the mining company—has been playing an important role in this progress, and most certainly warrants discussion and analysis.

Steadily increasing demands for the industrial minerals caused established “non-metallic” mining companies to expand and increase their productions. Many of the well established “metal” mining companies began to realize that expansion and diversification to the industrial minerals offered new opportunities—especially in view of uncertain metal prices. Similarly, new mining companies were organized whose principal objectives have been the exploitation of the industrial minerals, not metallic ores.

Of what significance are the industrial minerals to our national economy? Why have newly-formed mining companies favored the industrial minerals, rather than the metals? What gains may be realized, and what problems lie in store for each of the new companies? The answers to these questions are both interesting and worthy of study if the “modern trend” in mining is to be properly evaluated for its present and future potential.

Gross Dollar Value Exceeds That of Metals

A very complex network of scientific and economic developments have provided us with an economic environment suitable to the sale of the

—it must be prepared to accept the challenge of a highly competitive market

established industrial minerals. This environment has materialized almost entirely without the “romantic glitter” that usually accompanies the mining, milling, and marketing of metals. Instead new industrial products have been developed, or previously established markets have been expanded, because of either consumer demand or improved manufacturing techniques. The salable products frequently contain several industrial minerals and chemicals treated to

form the desired end-product, and the minerals or compounds contained within the finished product lose their identity behind a brand name. Sale prices, per unit, have rarely soared to spectacular heights. However, the annual gross dollar value of industrial minerals produced in the United States has increased rapidly and now far exceeds that of the metals. Thus the demands for raw materials have increased and the opportunities presented to the individual mining com-



Special attention is being directed at the present time to the Sun Valley Barite mine near Hailey, Ida. (pictured above), the Simplot Silica Products operation at Overton, Nev., and the Miclesil mine near Bovill, Ida.

and Industrial Minerals

By CHARLES W. SWEETWOOD

Assistant Manager
Exploration Division
J. R. Simplot Co.

pany are greater than ever before. The industrial minerals have become well established in a position of importance within our national economy.

The new mining company interested in the exploitation of industrial minerals quickly finds that the challenge will probably offer pleasant possibilities for a long term operation not normally affected by sudden, or unexpected, price fluctuations. The com-

pany also quickly realizes that it cannot concern itself merely with the mining and milling of a potentially marketable ore. It must, in fact, become more than just a mining company in the true sense of the term. Some of the necessary prerequisites customarily encountered both prior to, and during operation are:

(1) Chemical and metallurgical research—to improve upon, or develop

new, processing techniques.

(2) Extensive exploration and ore reserve development.

(3) Market surveys—to include transportation of products to market.

(4) Detailed long-range economic evaluations—to include prevailing or potential competition.

(5) Pilot plant studies.

(6) A low cost, high efficiency, beneficiation or processing plant.

(7) A low cost, large tonnage mining operation.

(8) Full utilization of all possible by-products.

(9) A highly efficient sales organization.

Additional problems quite probably would develop, peculiar to the particular product, or products, to be obtained. The final analysis would, of course, be resolved upon the basis of the sale price, or prices, of the beneficiated or processed product. In this regard, the value per ton can usually be expected to be relatively low when compared to the metals, and satisfactory net profits may generally be possible only if relatively large low-cost annual tonnages can be realized.

Field Is Open to Big and Small Operators

It is not the intent of this presentation to imply that the problems affecting the exploitation of any industrial mineral would be virtually insurmountable within today's highly competitive economy. Neither is it intended to suggest that only a large company, with vast reserves of working capital, can successfully compete upon the open market. Many fields are available today for the small, or medium-sized, mining company—providing all problems are weighed accurately both prior to and during actual operation, and providing the operators possess the farsightedness and initiative required of those that realize that the industrial minerals seldom permit a "get rich quick" operating clause.

The growth and development of the J. R. Simplot Co. is quite possibly a very good example of the success



The success of the Centennial mine, located in the rugged Centennial Mountain Range on the Idaho-Montana border, indicates that industrial minerals can be economically exploited under extremely adverse conditions of operation

that might be achieved by a relatively small company. This organization has been in existence as a mining company for only 12 years. During this period, progress and expansion has been a constant part of each day's work, and most of the efforts of the company have been directed toward the successful exploitation of certain of the industrial minerals. Of course, it is true that the company has, from time to time, concerned itself with metals as opportunities presented themselves. Nevertheless, the company first became interested in mining when the need arose for phosphate rock to supply the company's superphosphate fertilizer plant at Pocatello, Idaho, and its primary concern ever since has been to thoroughly exploit this vitally important industrial mineral—as well as other industrial minerals of importance to the ever-expanding markets of the west.

Development of Low Grade Deposit Provides Example

The initial exploitation of the phosphate rock (as well as all other industrial minerals interests of the company) did not originate as an accidental find, or surprise discovery. The potentiality and feasibility of such a mining operation first became apparent to Mr. J. R. Simplot during the fall of 1945. By January 1946, following a comprehensive economic study, the outstanding far-sightedness and determination of Mr. Simplot first began to exert itself toward actual mining. A mining staff was organized with instructions to "find a mineable phosphate property" and shortly thereafter the Gay mine was born. This property, situated 30 miles north of Pocatello, Idaho, within the Fort Hall Indian Reservation, first became a producer during the summer of 1946 with a total of 58,500 tons of high grade (plus 31.5 percent P_2O_5) phosphate rock mined and shipped to the Pocatello plant. This small tonnage was mined strictly under experimental operating conditions by open pit mining methods to determine operating costs, the method of mining most suitable to the prevailing conditions, and (above all) the average mine-run quality of the available material.

A successful operation was immediately apparent, but a serious problem also existed. The phosphate rock mined and shipped during 1946 came exclusively from the lower bed of phosphate rock of the Phosphoria Formation. A thick phosphatic shale member overlies this high grade bed and commonly reaches thicknesses of 100 ft when not affected by erosion. The phosphatic shale, and inter-bedded limestones and siltstones, had been reluctantly treated as waste overburden. If this practice were allowed to continue over a period of

years, both the total life and dollar value of the mine would be restricted. Even though the phosphatic shales of this region (and of this property) are of too low grade for utilization without beneficiation in the fertilizer industry, it was known that they do have direct value to the chemical industry. However, a familiar stumbling block to the industrial minerals mining company loomed up menacingly at this point—chemical plants designed for the utilization of the phosphate reserves of this well known, but virtually undeveloped, source absolutely did not exist. Transportation costs to existing plants in the southeastern United States would have been entirely prohibitive. It remained, therefore, to bring the chemical industry to the intermountain west.

Mr. Simplot immediately began a concentrated campaign to attempt to interest the chemical industry in these vast reserves. First, an extensive exploration program was undertaken to locate and secure under lease all available properties containing near-surface and easily mineable phosphate rock and phosphatic shale within the entire western field encompassing Idaho, Montana, Wyoming and Utah. Each of the properties acquired were drilled, trenched and sampled. While this program was under way, a similar (but more detailed) program was being carried out at the Gay mine to prove the true potential value of the property. As a further aid toward development, several U. S. Government export contracts were taken during 1947 and 1948 for shipment of mine-run ore to Japan. These contracts permitted use of a portion of the phosphatic shales, and aided materially in developing low-cost mining methods for future economic evaluations.

Thus, the Gay mine expanded to a production of over 500,000 tons of ore mined and shipped during 1947, and at the same time became a testing ground for a more thorough utilization of the Phosphoria Formation than had ever before been possible. The well exposed pit faces, stockpiles and geologic records at Gay, together with approximately 12 other phosphate properties acquired during the extensive exploration program, provided substantial evidence that the western phosphate field held immediate potentialities for the chemical industry—and particularly for the first companies willing to make the investment. The evidence proved to be sufficient to interest, first, the Westvaco Chemical Corp. (now the Westvaco Chemical Division of the Food Machinery and Chemical Corp.), and second, the Monsanto Chemical Co. Westvaco entered into a long-term contract with Simplot in 1949 to supply their newly constructed elemental phosphorus plant at Pocatello, Idaho.

Annual tonnages to Westvaco average approximately 600,000 tons of 24 percent P_2O_5 phosphatic shale per year at this time. The Monsanto followed shortly, by further developing Simplot holdings in the vicinity of Soda Springs, Idaho. A group of these properties were purchased by Monsanto, construction began on their large elemental phosphorus plant north of Soda Springs, and initial mining began on the Ballard property in 1951. Full production has been in effect since 1952, utilizing over 500,000 tons of high quality phosphatic shale per year.

Western Phosphate Demand Continues to Increase

Other companies have followed, and certainly still others should come in the future, to further develop the reserves of the western phosphate field. The door has been opened to a field of exploitation that suggests continued expansion as the demand for phosphate continues to increase—and this demand has been increasing steadily.

It was felt by many that inasmuch as the better phosphate properties of this western field had either already gone into production, or were being held for later use, a saturation point had been reached, and that demands for the raw material from the west would level off. This does not appear to be the case, and an example of this can again come from the recent experiences of Simplot. Continued requests for the sale of raw, untreated, mine-run material caused this company to explore and acquire the heretofore inaccessible Centennial Mountain Range on the Continental Divide, approximately 45 miles west of Yellowstone National Park. Development of this property (the Centennial mine) was completed in 1955, and active open pit mining began in 1956. 90,000 tons of high-grade phosphate rock were mined and shipped to the Northwest Nitro-Chemicals, Ltd., of Canada in 1956, and 150,000 tons were shipped during 1957 for processing into triple superphosphate fertilizer. The operational hazards at this property are many, because of its geographical position. All ore to be mined within the next five years, in particular, will come from elevations in excess of 9,000 feet, and from areas of rugged, mountainous, terrain on the Idaho-Montana border. The extreme elevation restricts the period of operation to approximately five months out of the year, and the winters in the Centennial Range are notoriously severe. All ore must now be moved by truck—a distance of 40 miles to the railhead at Monida, Mont. (plans call for a spurline to be constructed to within 10 miles of the mine, at a later date), and then shipped to Medicine Hat, Alberta, Canada.

With the Centennial mine the com-

pany again became involved in an experimental mining problem. In this case, the experiment concerned the over-all economics of operation, rather than the more fundamental problems that originally affected the early operation of the Gay mine. The operational hazards of the Centennial mine were thought by some to be insurmountable at this time for such a low priced material. However, the first year of operation not only proved this to be incorrect, but substantially established that the property will be a relatively low cost operation throughout all of its open pit life. A beneficiation plant, and an underground mining program can also be incorporated at a later date. Furthermore, the success of this operation should be indicative to all industrial minerals operators that these products often can be economically exploited under extremely adverse conditions of operation. Certainly, the successful operation of this particular property has shown the staff of Simplot that many new possibilities for the exploitation of the industrial minerals do exist today that may not have been thought possible—or may not have been possible—just a mere few years ago. The combined phosphate rock and phosphatic shale tonnage produced by this company during 1957 exceeded 1,000,000 tons. Greater annual production totals can be anticipated for the future.

Ventures in Other Fields Provide Challenge

The satisfactory economics of the western phosphate picture has, quite naturally, led the company into the production of other industrial minerals within the past 12 years. These have included fluor spar, barite, silica, and most recently clay. None of these ventures have yet developed into annual tonnages as great as that realized from phosphate mining. Nonetheless, the economic future is bright. Special attention is being directed at the present time to barite from this company's Sun Valley Barite mine, near Halley, Ida., the Simplot Silica Products operation at Overton, Nev., and the Miclasil mine (Mica-clay-silica) near Bovill, Ida.

The Sun Valley Barite mine will produce approximately 50,000 tons of ore this year of plus 4.0 specific gravity barite for use as an oil well drilling mud. The property also contains relatively large tonnages of sub-marginal grade ores that, to date, have been stockpiled pending utilization at some later date. Chemical beneficiation tests, though partially successful, have not proven to be entirely satisfactory; however, a new series of tests have been initiated that may eventually lead toward the successful utilization of these low grade materials.

The Simplot Silica Products opera-



Through farsightedness and determination the Gay mine near Pocatello, Ida., paved the way for development of the western phosphate industry

tion has been successfully supplying glass and foundry markets of the Pacific Coast since February, 1955. Annual tonnages now average approximately 60,000 tons per year of washed and sized silica. Increased annual tonnages, and profits, have been substantial enough to indicate that most certainly an economic operation will be entirely feasible at this property for many years to come.

The research, exploration, development and economic evaluation of the Miclasil property constitutes the most recent project of the company. It was recently announced that a \$750,000 pilot plant would be constructed within the Bovill area during 1958 as the initial step toward the production of processed clay and silica for industrial uses. This announcement follows two years of laboratory study, metallurgical research in conjunction with the United States Bureau of Mines, and very extensive geologic and economic surveys. Many problems have been solved, but many more remain. Of all the industrial minerals properties dealt with, and of all the problems encountered to date in each of these, none other has proven to be as complex as this. It has, to date, demanded far more study than any venture yet attempted. All of the experience, background and general "know-how" gained to date has had to be, and will continue to be, called upon in the attempt to successfully develop this property to its fullest possible extent. Several end products, with a large number of potential markets are indicated. The property contains a multi-product potential, and this multi-product potential is absolutely required if production is to become a reality.

Competition is keen within the glass, silicon-carbide, foundry, smelter, paper, petroleum and chemical industries—and adequate sales must be

developed within each of these markets if an economic operation is to be realized. The systematic development of the Miclasil property has carried with it a challenge never before experienced by this company. The success or failure of the project will, of course, be largely dependent upon the combined ability of the entire organization to mine, process, and sell the finished products. Markets are, and can be made available.

New Mining Era Said to Exist

As stated earlier, we are now well established within an economic environment suitable to the sale of industrial minerals. It has also been said by others that an "Industrial Minerals Era" exists. If this is so, then it remains for the industrial minerals mining company to take full advantage of the many opportunities afforded the industry at this time. The new mining company, regardless of its individual field of endeavor, is now being presented with opportunities never before realized in the history of mining in the United States. New property discoveries are not necessarily required. Excellent but undeveloped, properties of varying types are known to exist in every state. Both the United States Geological Survey and the United States Bureau of Mines have dedicated many years toward the discovery, exploration and evaluation of industrial minerals properties. Their published information can be invaluable.

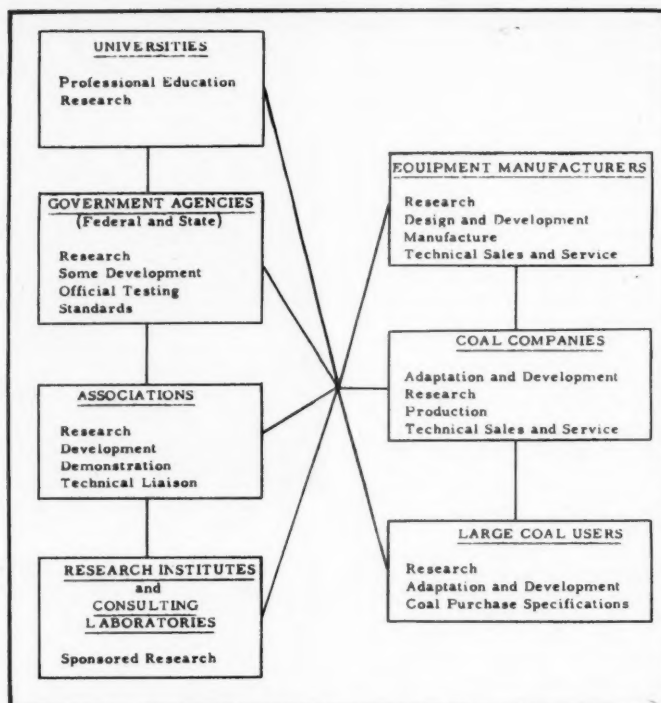
Statistics prove that the new company, regardless of its size or affiliation, will succeed—if that company is fully prepared to accept the challenge of our highly competitive industrial market, and if that company is fully prepared to not only fully develop, scientifically mine and thoroughly process its product, but also sell it by offering a better product at lower cost to the consumer.

PRESENT STATUS of Coal Research

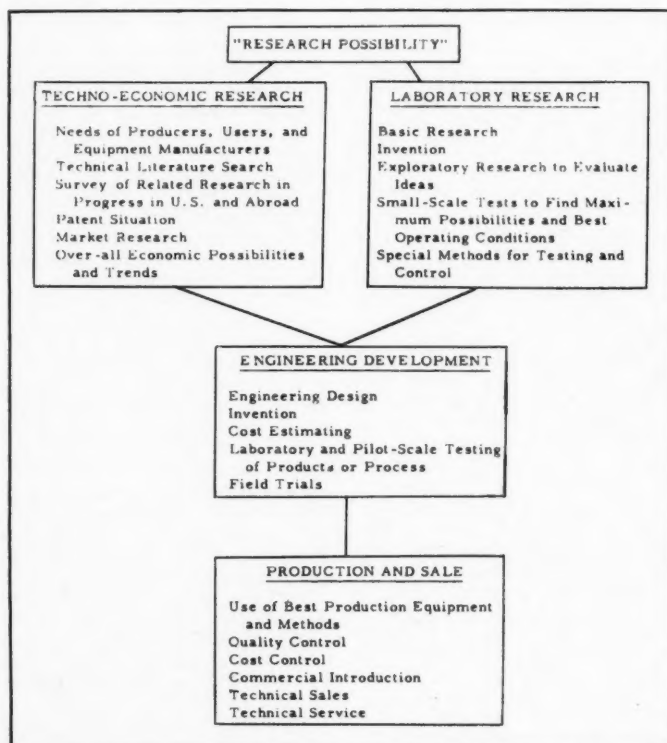
Research is the lifeblood of any progressive industry and is highly essential to insure an ability to meet constantly increasing competition

By A. A. POTTER

President, Bituminous Coal Research, Inc.
and Dean Emeritus, School of Engineering
Purdue University



Types of organizations now carrying on research and related activities pertaining to coal



Steps involved in research, engineering development and related activities to convert a "research possibility" into commercial use

AS far back as 1951 the writer has pointed out that the research organization of the coal industry, Bituminous Coal Research, Inc., should concentrate upon problems of interest to its largest customers, particularly the electric power industry and the combined market of retail deliveries and industrial users. In 1957, 157,400,000 tons of coal were used by the electric utilities; retail deliveries and industrial uses during the same year represented about 139,400,000 tons; and coking coal, 108,000,000 tons. The writer has called attention to several of the problems which need more research and urged those interested in a prosperous coal industry to insure not only more coal research, but also its more effective utilization and better commercialization of the new mining and coal burning equipment developed in the laboratory.

This article shall summarize briefly the status of coal research in this country and in Europe, and shall report on the progress made by the coal industry in research, development, and in the utilization of laboratory developments.

United States—\$17,000,000 Expended for Research

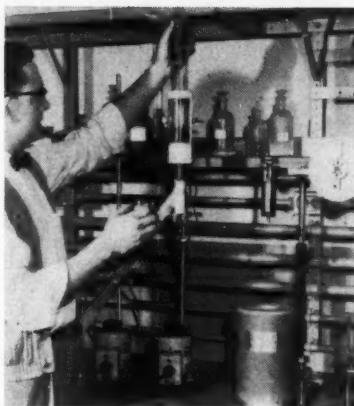
The areas of research in which the bituminous coal industry has the greatest interest are those most nearly related to the markets it serves. These include projects which may result in more efficient equipment that meets competition with other fuels and that burns coal with a minimum of air pollution, better coal handling, and storage devices, improved instrumentation to insure a maximum of automatic control, and in other improvements that give satisfaction to the user of coal. Research is also needed to insure maximum economy in coal mining and preparation to produce a product for specific markets.

About two years ago the U. S. Bureau of Mines, in cooperation with Bituminous Coal Research, Inc., surveyed the status of research on bituminous coal. The results of this study, which is considered the most authoritative, were published in U. S. Bureau of Mines *Information Circular 7754* (May 1956). This report estimated that during 1955 about \$17,000,000 were expended for bituminous coal research, as compared with \$146,000,000 by the petroleum industry and \$361,000,000 by the chemical industry. Of the \$17,000,000 spent for bituminous coal research in 1955, coal equipment manufacturers and other industrials contributed 47 percent; the federal and state governments, 31.3 percent; commercial coal, 14½ percent; captive coal, 7 percent; and universities, less than ½ percent.

J. W. Igoe and H. J. Rose of the Bituminous Coal Research, Inc., staff, in an article prepared for the annual review issue, February 1957, *MINING CONGRESS JOURNAL*, covered coal research for 1956. Their survey indicates that, while more than 57 percent of the money spent on coal research involves conversion of coal prior to its use and about 20 percent is in the field of mining and preparation, only 6.4 percent is being invested in projects related to coal combustion.

Europe's Programs—Diversified, Expanding

Dr. H. J. Rose, vice president and consultant for BCR, as a result of a recent visit to the leading coal-research laboratories of Europe, reports that coal research is expanding abroad; new research buildings are occupied or are under construction, coal research staffs are being increased, and modern research equipment is being installed. A total of more than 3000 persons are now engaged in research and development work on coal in Western Europe, and there are believed to be more than



Significant progress has been made in an investigation of factors affecting the plasticity of coal. Results of this study should prove helpful in the better design of coal-burning equipment and in reducing developmental costs

5000 additional coal research personnel in the U.S.S.R. The combined figures for Europe are some four times as great as the personnel similarly employed in the United States. Dr. Rose's observations were reported at the 1958 BCR Meeting in Pittsburgh on April 24, 1958, and through a special brief distributed to BCR members. A resume of his observations regarding coal research programs of the leading coal-producing companies of Europe follows:

There are diversified programs of coal research and development work in each of the major coal-producing countries of Europe. Only five of the countries, and only some of the general subjects of the hundreds of foreign coal research proj-

Internationally known, Dr. A. A. Potter's entire professional career has been spent in research and education in the fields of fuel and power generation. From



1903 to 1905, he was employed by the General Electric Co. In 1905 he joined the staff of Kansas State College, becoming dean of engineering and director of the Engineering Experiment Station in 1913. He resigned in 1920 to accept the position of dean of engineering schools at Purdue University. For 33 years he served as dean and director of the Engineering Experiment Station and the Engineering Extension Service, and in 1953 was made dean emeritus of engineering. He became president of Bituminous Coal Research, Inc., on a part-time basis June 6, 1950.

In addition, Dr. Potter has a long record of service on government boards and committees and, for more than 30 years, has served in the capacity of consulting power engineer. He has been honored repeatedly for professional achievement, is the author of a number of books on power engineering thermodynamics and motors, and has had published more than 300 engineering, educational, and scientific articles.

ects, will be mentioned here. Excellent facilities are provided in each country for fundamental and applied laboratory research, pilot-scale testing, and full plant scale testing and evaluation of research developments.

Great Britain. More than a thousand persons are employed in scientific research on coal mining and preparation techniques, engineering design and evaluation of full-size equipment and supplies, improved instrumentation for mines, washeries and processing plants, methane and dust and other safety problems, improved combustion equipment of many types and sizes, fireside boiler deposits, processed fuels, underground gasification, and many approaches to smoke prevention and fuel economy. An impressive amount of basic research is being done on the chemical and physical properties of coal to permit new solutions to coal industry problems.

France. Research fields include explosives, ventilation, silicosis, safe mining equipment, recovery and cleaning of coal fines, briquetting, chemical and physical properties and structure of coal and coke, carbonization, gasification, combustion, evaluation of new coal-burning equipment, and development of improved analysis and test methods.

Germany. Very diversified work is in progress by German coal associations, in industry committees and companies. The scope includes coal geology, most every phase of underground mining and safety, silicosis, power production for mines, novel preparation methods including production of low-ash coal for special uses, properties and petrology of coal, briquetting, combustion, control of fireside boiler deposits, evaluation of residential and commercial heating equipment, carbonization and chemical products, coke quality, moderate-Btu pipe-line gas and fuel gas from high-ash coal, chemicals by coal oxidation, etc. In addition to laboratory research there is much development work on coal cleaning processes, gasification, etc., in large-scale equipment.

Netherlands. More than a thousand persons are engaged in research on the mining, preparation and use of coal, including coking and the manufacture of chemicals, plastics and fertilizers in huge integrated industrial plants adjoining the coal mines.

Hydraulic shaft sinking, methane drainage in advance of mining, vacuum dedusting of mines, instrumentation for greater safety in mining including pressure-measuring devices, compact hydrocyclones for coal cleaning, high capacity non-clogging screens for coal slurries, and utilization of high ash middlings are some of the activities. Fundamental research on coal itself, prediction of methane yield during mining, selection of the best mixtures for coking, the contribution of individual coal components to coke structure, and manufacture of brick from mine refuse and fly ash are some other activities.

The International Flame Radiation Laboratory, which is collecting basic data from large scale tests of the combustion of fuels including pulverized coal, is located in the Netherlands.

Soviet Russia. Facilities for coal mining research and development work are known to be on a massive scale in the U.S.S.R., and there are probably at least 5000 qualified scientists, engineers and technologists employed by the large number of coal research institutes in Russia.

The Soviet mining industry plans to produce about 600,000,000 tons of coal annually by 1960, which will necessitate putting into operation more than 300 new collieries and strip pits. A great deal of engineering development work and adaptation is being done on coal cutting

and loading machines, techniques, and team organization for high outputs. Equipment and methods have been developed for mechanization of shaft sinking processes to give high, steady sinking rates of hundreds of feet per month. Much attention is being given to hydraulic mining methods including shaft sinking, loosening coal at the face, transportation underground and lifting of coal to the surface—all by hydraulic methods.

As an example of intensive work on specific problems, 11 research institutes and 13 special field teams under a coordinating committee are said to be studying the problem of outbursts of coal, rock, and gas, and developing preventive measures.

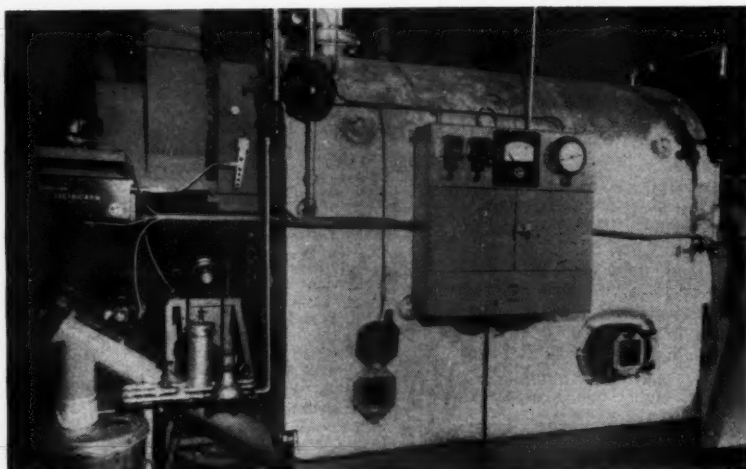
Coal Research Center

In the writer's contacts with coal producers and users the past few years, he has stressed the importance of accelerating coal progress through

tion and combustion, generation of industrial heat and steam, coal use problems important to power generation in electric central stations, on projects affecting metallurgical, carbonization, gasification and chemical uses of coal, and for the development of improved coal-burning equipment. It is also hoped that means will soon be available so that BCR is in a position to carry on more basic research, the results of which will have long range benefits to the producers, carriers, and users of bituminous coal.

BCR Stewardship Report

A brief stewardship report on the recent progress made by BCR will now be presented.



A fully-automatic coal-fire package boiler with continuous mechanical ash removal has been designed

a more effective industry research and development program, and pointed out that a research center, owned, operated, and staffed by the bituminous coal industry through BCR, is the best way to implement such a program. It was not until the fall of 1953 that the first industry-owned laboratory for BCR was constructed at Columbus, Ohio. This is a very modest laboratory, but the results obtained at this facility in the development of new methods and equipment for burning and for handling coal led the BCR Board of Directors to establish in 1955 additional laboratory facilities in Pittsburgh, Pa. It is now most gratifying for the writer to be able to report that the bituminous coal industry and its friends have encouraged the BCR board and staff to plan a major research facility in the Pittsburgh area for the consolidation of the present activities now located at Columbus and Pittsburgh. The establishment of this central laboratory for bituminous coal will permit expanded research on coal prepara-

tion and combustion, generation of industrial heat and steam, coal use problems important to power generation in electric central stations, on projects affecting metallurgical, carbonization, gasification and chemical uses of coal, and for the development of improved coal-burning equipment. It is also hoped that means will soon be available so that BCR is in a position to carry on more basic research, the results of which will have long range benefits to the producers, carriers, and users of bituminous coal.

1. A coal-fired package unit, now in production, that is fully automatic including transfer of coal from the bin to the burner, burning the coal, and discharge and removal of the ashes. The unit is so designed that it can be completely assembled and pretested at the factory and shipped to the customer intact ready for connection to power, water and steamlines. Four of these commercial units are now in operation, and the manufacturer has inquiries and orders on hand valued at several hundred thousand dollars.

2. A conversion burner, the Fire Jet, for existing boilers to insure automatic coal burning.

3. An improved coal flow device that makes possible uninterrupted flow of coal from storage bins, bunkers, and silos through a 12-in. diameter opening using $\frac{1}{4}$ to 0 in. coal containing more than 15 percent surface moisture. A number of installations in new and existing bins are now under way utilizing this BCR Easy-Flo Bin. This coal flow device is applicable to all coal storage bins, including those at utility and preparation plants.

4. A package-type residential coal-burning unit, the Coal-O-Matic, available for hot water and warm air heating and in two sizes. This residential heating unit has passed a large number of field tests, and is now ready to fill this need in the retail segment of the industry.

5. In addition to the above BCR developments, it recently has evolved in its Columbus laboratory new knowledge that is reducing to a minimum, by use of low cost water sprays, the soot blowing dust emission problems in small power plants.

The above are examples of BCR activity in the field of retail deliveries and small industrial uses. In the expanded BCR program, now being planned, it is expected that more new devices will be developed to serve the future needs for industrial steam and space heating with coal-burning equipment. The technical aspects and economics of handling small amounts of coal pneumatically will be investigated, as well as pneumatic ash handling methods. New knowledge is also needed regarding the practicability and market potential of large warm air coal-burning heating units and new principles for coal burning in small plants must be constantly evolved.

As indicated earlier in the article, the benefits to the coal industry from new developments by BCR can only be realized if its efforts are supplemented by active promotional, sales, and service activities. The present activities of the Bituminous Coal Institute and Automatic Solid Fuels Equipment, Inc., are most encouraging in this regard, and if properly managed and financed should result in commercialization of BCR results for the benefit of the coal industry.

It is gratifying to be able to report that BCR has made significant progress in an investigation of factors affecting the plastic properties of coal; this study, it is hoped, will reveal why different coals perform in different ways while being burned. Results of this study should prove helpful in the better design of coal-burning equipment and in reducing developmental costs. A part of this project, that phase relating to Pennsylvania coal, has received a substantial grant for two years by the Commonwealth of Pennsylvania under the direction of the Pennsylvania Coal Research Board. BCR, with its own funds, has been carrying on a parallel investigation on the coal plasticity of non-Pennsylvania coals.

Projects of Special Interest to Electric Power Utilities

In the very important electric utility coal market, BCR has had good cooperation and considerable encouragement from the electrical power industry, and is actively at work on the following projects:

1. Evaluation and exploratory research on methods for control of atmospheric contaminants in flue gases. Considerable attention is being given by the U. S. Public Health Service and air pollution con-

trol authorities to this problem. BCR, while careful to avoid duplication, is keeping fully informed about activities in this field, both in this country and in Europe. At the same time, BCR is evaluating the more reasonable processes which have already been proposed for the removal of obnoxious ingredients from stack gases, and is carrying on laboratory research to develop new and better methods for the control of contaminants. In addition, the organization is surveying and evaluating published reports on the significance of various stack gas contaminants in the formation of smog and their possible effects on health.

2. Methods for decreasing sulphur in steam coals. BCR has made a comprehensive survey, and has reported on the sulphur reduction possibilities and limitations of existing coal cleaning processes. It has summarized the scientific knowledge now available on the chemical and physical forms in which sulphur exists in coal, and has now under way exploratory research in this field utilizing new ideas suggested by its staff and others.

3. Utilization of fly ash. BCR is continuing its efforts toward the development of increased uses for fly ash. The firm has recently published a BCR Fly Ash Manual that has had wide demand, and efforts up-to-date have resulted in increased use of fly ash for the road and building construction industries. BCR is now conducting studies on methods for making fly ash acceptable for large markets and new uses, and is cooperating with producers and users of fly ash in techno-economic research and market development. It is conducting laboratory studies to provide technical data on fly ash and for improving fly ash specifications.

In its enlarged program BCR expects to accelerate its efforts in the above fields of research and to consider other projects of special interest to the electric power utilities, examples of which follow:

1. Development of improved handling and storage of coal at lower cost than the present mechanical handling equipment and large overhead bunkers.

2. More economical methods for removing solids from stack gases without sacrificing boiler efficiency.

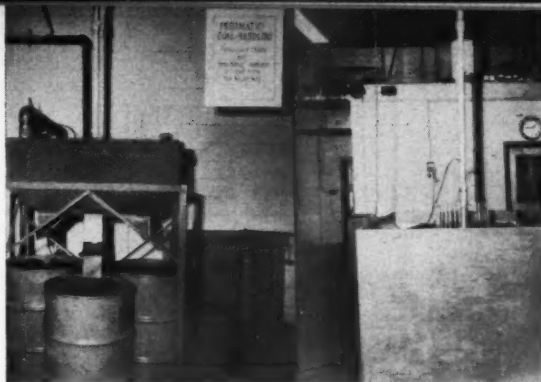
3. The development of more knowledge on behavior of coal minerals at high temperatures, the mechanical and chemical methods for removing fire-side deposits from large boilers, and similar problems affecting deposits on convection surfaces of utility boilers which affect their efficiency.

Other Problems That Require Research, Development

In the enlarged program BCR expects to give also special attention to coal preparation problems, including controlled thermal drying of coals, basic principles of coal breakage, new coal cleaning methods such as electrostatic separation, refuse disposal from cleaning plants, material handling in the preparation plant, stream and air pollution by waste products from the cleaning plant, means for reducing fine coal production and similar problems of special interest to the coal producing companies.

More knowledge is also needed on the chemical and physical properties of coal, including its origin, structure and chemical behavior. There are also difficult problems to be solved

In the expanded BCR program now being planned, the technical aspects and economics of handling small amounts of coal pneumatically will be investigated, as well as pneumatic ash handling methods.



connected with supplying increased quantities of coal to meet specifications of existing and future iron and steel processes. Coal is bound to become of great importance for non-ferrous metallurgy, especially for power in connection with aluminum production. Much research will be needed to establish precarbonization on a large scale. Active research will be needed to increase the use of coal as a chemical raw material.

The above recital covers only a few of the many problems that require more research and development as insurance to the coal industry's future prosperity. No mention was made of the field of coal mining.

The coal industry produces and markets a commodity which is essential to national welfare and security. For coal to participate fully in the ever increasing energy demand of

this country and of the world, vigorous coal research and development programs must be developed and carried out. Research is the lifeblood of any basic and progressive industry, and is highly essential to insure any industry's ability to meet constantly increasing competition. It is hoped that BCR, through its research and development activities, will prove helpful in uncovering new uses for coal, in meeting competition from other forms of energy, in insuring greater satisfaction to the user of coal, and in building up the world over, customer and public confidence in the American Bituminous Coal Industry. BCR, as the research organization of the bituminous coal industry, must assume responsibility for the generation of short-range and long-range research programs in the interest of coal's future.





Utah Construction Company's Burke Pit at Iron Mountain, Utah

Economy of Larger Shovels

By EARL F. HANSON

WITH steadily rising labor and material costs, it behoves management to continually seek ways and means of increasing the mechanical efficiency of equipment in order that production costs may be held down.

Because of the persistent wage raises, mining executives are focusing their attention on deposits of metal which can be mined from the surface rather than by underground methods. In surface mining by open pit method, the direct labor cost is comparatively small as compared to underground mining—the chief cost is equipment maintenance and depreciation.

It is an axiom that the larger the operation the lower the unit cost. This is true providing the selection and integration of equipment is tailored for the job.

Considerations in Determining Equipment Size

The size of earthmoving equipment for strip mining is generally determined by a number of considerations. These include the following:

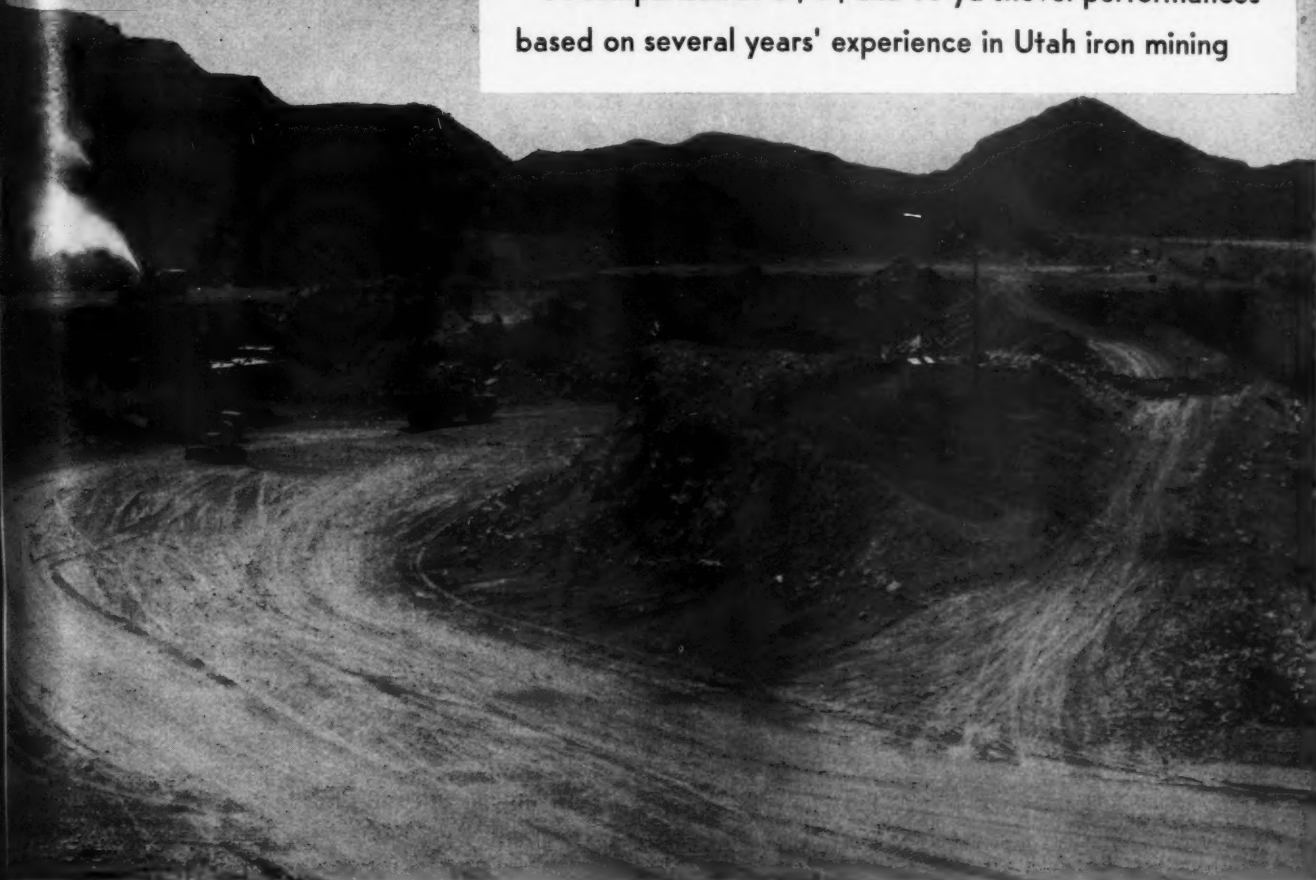
1. Total number of cubic yards of material to be moved and production rate.
2. Operational mobility.
3. Transportation equipment available for hauling.

1. Size of Operation

The selection of the particular size of shovel to be used on a particular job is generally determined by taking into consideration the daily production required and the total quantity of material to be moved.

Large capacity mining and stripping equipment costs a great deal of money to purchase, to erect and

A comparison of 6-, 8-, and 10-yd shovel performances based on several years' experience in Utah iron mining



to move as well as to maintain. Therefore, the amount of material to be moved, more or less is directly related to the investment required.

The cost of the various pieces of equipment which are under consideration is as follows:

Size of Shovel (cu yd)	Factory Purchase Cost	Approx. Hourly Ownership Cost
6	\$261,650	\$14.00
8	334,293	18.50
10	430,200	24.50

Following is a breakdown of the charges against the equipment for accounting purposes which includes equipment depreciation, annual overhaul, overhead expense (insurance and taxes, plus district yard operations). The rental rate of the equipment is the total of these categories and con-

stitutes the hourly rate charged for an individual piece of equipment.

2. Operational Mobility

When the amount of material to be moved is large and a high rate of production is required, there is no problem in selecting the most suitable size shovel. In most every case the equipment must be moved to a new location. The following is a tabulation of data which must be taken into consideration in moving a shovel, and also labor and cost involved in the moving.

The cost is determined, to a large extent, upon the mechanical handling equipment available. It is

more desirable to have two 25 to 35-ton cranes available for the dismantling, loading and erection of the 6-, 8- and 10-yd shovels.

3. Hauling Equipment

Large shovels must have haulage companions to match in order to attain maximum production. The 10-yd shovel can load a 50-ton, 600-HP, 34-yd end dump truck in three or four passes. Likewise, the 6-yd shovel can load a 25-yd truck in four or five

Breakdown of Maintenance and Operation Expense

Size of Shovel (cu yd)	Lubrication						
	Cost	Repair Parts	Electric Power	Misc. Equipment	Job Shop Expense	Labor Insurance Taxes	Total M&O Expense
	%	%	%	%	%	%	%
6	1.5	39.1	12.8	2.8	20.9	22.9	100
8	1.4	35.3	15.5	3.6	23.5	20.7	100
10	1.3	31.5	18.7	3.8	26.1	18.6	100

Note: The above items may vary some, depending upon cost of electric power and facilities for repairs.

Size of Shovel (cu yd)	Total Use Rate	Maintenance and Operation Rate	Ownership Expense Rate	Depreciation	Major Overhaul	Overhead
6	31.00	17.00	14.00	5.21	6.25	1.82
8	38.50	20.00	18.50	6.65	9.20	2.70
10	47.50	23.00	24.50	8.43	12.53	3.54

passes. The most important thing is to keep haulage equipment cycled so that the shovel can work without interruption.

When the smaller size trucks are used considerable spillage results, adding to the clean-up time and often resulting in higher tire cost as the result of abrasion.

Description of Mining Operations

Utah Construction Co. commenced iron mining operations in Iron County, Utah in 1942, at Iron Mountain, located about 23 miles southwest of Cedar City, Utah. A 5-yd electric shovel was employed to mine and strip the Duncan and Blowout iron ore bodies which have supplied a substantial part of the ore used by an out-of-state plant.

A second iron mining operation was started late in 1944 at Iron Springs, which is situated about 10 miles west of Cedar City, in order to supply a western steel company with a substantial part of their iron ore requirements. A 5-yd electric shovel was used at first and later a new 6-yd electric shovel was added which resulted in increased economy for the operation. This independent iron ore business, owned by Utah Construction, produces about 100,000 tons of high grade iron ore per month combined with approximately 100,000 cu yd of stripping.

A third operational unit was added by the company in 1949 in connection with contract stripping of several ore bodies at Desert Mound, situated about 13 miles southwest of Cedar City. Approximately 3,000,000 cu yd of medium hard limestone with some

Size of Shovel (cu yd)	Total Weight Tons	No. R.R. Cars	Moving Shovels			Dismantling and Loading for Shipment		
			Unloading and Erection					
			Maximum Lift Tons	Elapsed Days	Cost	Ballast Required	Elapsed Days	Cost
* 6	195.00	7	30.0	15	\$3,900	50,000 lbs	12	\$3,100
8	240.00	8	46.0	18	5,200	55,000 lbs	15	4,800
*10	343.74	9	66.5	21	7,000	60,000 lbs	18	6,000
								Total Cost
								\$ 7,000
								10,000
								13,000

*Note: One 15-ton crane and one 35-ton shovel crane used.

	Capacity of Bucket (cu yd)	Availability %	Total Moved (cu yd)	Approx. Cu Yds Per Hour (cu yd)	Cost of Loading (Relative)
Soft Rock					
Bingham Stripping	6	90	3,770,000	530	85
Bingham Stripping	10	92	2,730,000	850	75
Medium Hard Rock					
Iron Springs Mining and Stripping	6	88.9	1,500,000	440	100
Comstock Mining and Stripping	6	92.0	2,000,000	425	95
Desert Mound Stripping	6	86.9	12,000,000	405	90
Hard Abrasive Rock					
Blowout Mine and Stripping	6	86.2	1,200,000	360	110
Burke Stripping	6	86.6	1,446,700	390	106
Burke Stripping	10	89.4	2,803,300	550	102

valley fill was moved yearly for a period of about five years, totaling approximately 16,000,000 cu yd. Most of this was excavated with two 6-yd shovels.

A fourth unit was started in April 1953 and consisted of widening one of the existing pits at Iron Mountain. The stripping was confined to a relatively narrow bench in hard abrasive monzonite and quartzite. A total of 4,250,000 cu yd of rock was

moved during a period of 18 months, using one 6-yd shovel and one 10-yd shovel.

Early in 1954, work was started to prepare the Mountain Lion iron ore body, and the contiguous Comstock ore body for production. A new modern crushing and loading plant with large stockpiling and blending facilities was constructed a few miles northeast of the main Iron Mountain operation, and most of the production that was being shipped out of the state was transferred to this new unit from the Blowout pit. Mining has continued at approximately 100,000 tons per month combined with 100,000 cu yd of stripping. Two 6-yd shovels and one 5-yd shovel were used to load both the waste rock and ore.

Another large scale strip mining operation which is now going on is the high level stripping at the large open pit near Bingham, Utah. Work was started in the fall of 1956 and continued throughout the winter using three 6-yd shovels and one 10-yd shovel. Production during several months exceeded 1,000,000 cu yd of rock per month.

Comparison of Different Types

The following is a tabulation showing the production, availability and relative cost of the 6-and 10-yd shovels in three different types of rock. These figures are based on average mining conditions over a period of several months.

No comparative production figures are given for an 8-yd shovel because the figures available for this size unit are based on an entirely different



The most important factor in shovel efficiency is keeping trucks under the dipper so that the shovel can work continuously. Pictured are two units, a 6-yd (above) and a 10-yd (below), loading 45-ton trucks at the Burke Pit

Earl F. Hanson completed his studies in geological engineering at the University of Utah in 1925.



Upon graduation he went to work for Tintic Standard Mining Co. at Dividend, Utah. He worked as assayer, sampler, plant engineer, mining engineer, geologist and chief geologist from 1934 to 1948. Hanson then joined Utah Construction Co. as resident engineer in the Cedar City Operations. There he supervised plant construction, exploration, and development of iron orebodies in Utah and Nevada. He was appointed geologist, Salt Lake City District in 1951.

set of operating conditions and are not comparable.

For the purpose of making a comparison between production costs of the 6- and 10-yd shovels in loading three types of rock, the Iron Springs operation, where both medium hard iron ore is being mined and a moderate firm limestone is stripped, is used as a base and given a value of 100. The actual costs for the other operations vary—the cost of mining and stripping in hard abrasive rock at the Blowout being 10 percent higher and the Bingham stripping cost using a 10-yd shovel being 25 percent lower.

Summary of Experience

Experience over a number of years using various makes and sizes of shovels in mining and stripping in Utah has pointed up the following:

1. The most important thing to keep in mind is keeping trucks under the shovel in order that it can work continuously. The size of the trucks is also important. For greatest output nothing smaller than a 22-ton truck should be used, and preferably the 34-ton and 50-ton units. The larger units require a wide turning radius. If a short radius is used excessive wear on tires will result.

2. Experience has shown in the company's operations that the larger shovels show a marked increase in availability. The smaller the shovel the more repair and down time, and more especially when digging in hard rock. The availability is largely dependent upon the working conditions. As would be expected, hard abrasive material causes more down time drilling and shooting is a most important part of the operation. A shovel cannot load efficiently unless the rock is properly broken. Powder is cheaper than repair parts.

3. The 6-, 8- and 10-yd shovel can do almost anything the smaller shovel can do, and do it better and at a lower unit cost. In hard digging, the large units have a distinct advantage.

4. For maximum efficiency of operation an attempt should be made to keep the height of the working face between 25 and 40 ft where 6-, 8- and 10-yd shovels are used. When the shovel face does not exceed the height mentioned, it is possible to clean down the face preventing sloughing which provides safe working conditions and keeps muck and rocks from rolling into the shovel mechanism.

There is also an added advantage in drilling and shooting because there will be less burden at the toe of the face on the blast holes. In soft ground the edge

drill holes will be in a safer position.

5. The lunch period should be utilized by mechanics to make an inspection of the shovel, and to make minor repairs. When shovels are working round the clock it is well to designate one day each month for careful inspection and repairs. Some repairs can be deferred and taken care of on the repair day. The shovel can resume operation when it is back in good operating condition.

6. The various makes of shovels used have been quite satisfactory. Each has its strong points as well as an occasional weakness. The various makes and models are incorporating constant improvements in design and materials. This cannot be said for the workmanship. The fabrication and the assemblage of heavy equipment seems to show lack of thorough in-

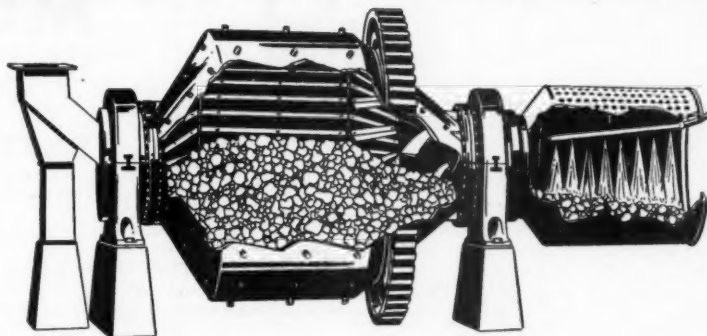
spection and in general is not quite up to standard in workmanship the past years.

7. Because of the large capital investment in a shovel the operator is of great importance. It has been observed that the best operators on large electric units have been those who started their training on smaller electric units rather than those who had previous experience on the diesel powered machines.

8. Safety and efficiency in shovel work starts with the project manager and goes all the way down through the organization.

9. It has been observed in Utah's operations that aside from daily output there is only a small difference in unit costs between 6-, 8- and 10-cu yd shovels working under similar conditions.

HARDINGE SCRUBBERS FOR PIT-RUN MATERIALS

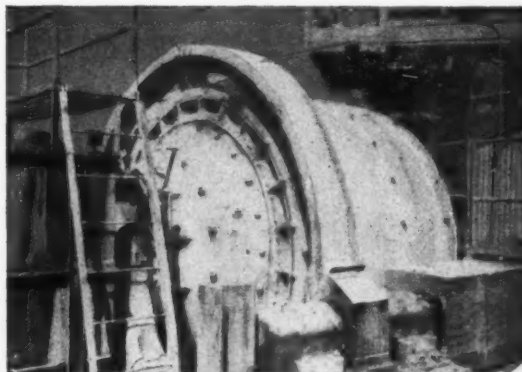


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View of a 10' x 66" Hardinge Scrubber cleaning crushed dolomite in a California plant.



Write for Bulletin 37-B-52.

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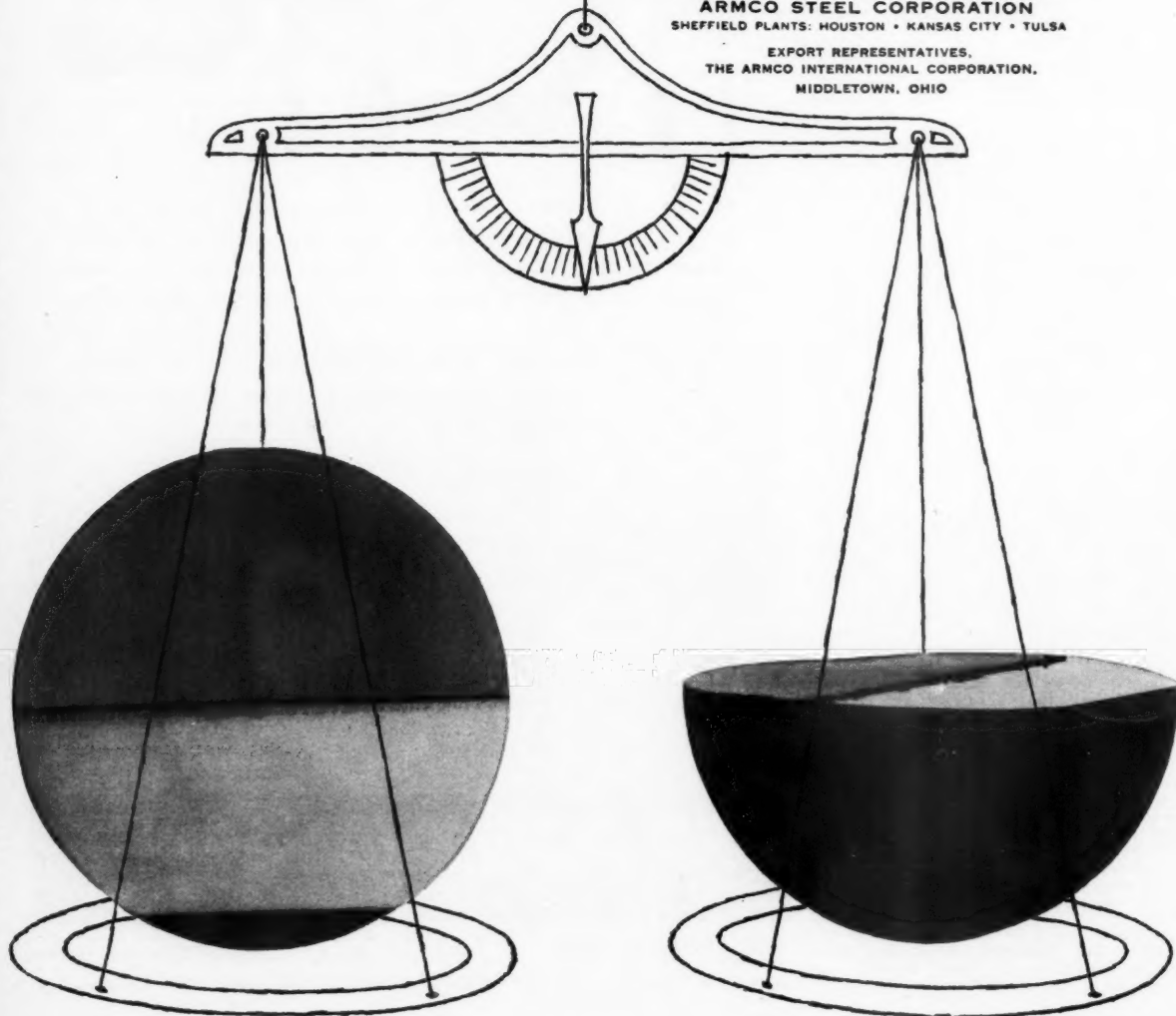
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A LOOK AT COAL

By JOHN L. LEWIS

President
United Mine Workers of America



It's challenged again by the same old opponent—apathy

Assuredly, I consider it a great privilege to attend this meeting of the American Mining Congress and to meet with the men who are largely responsible for the successful operation of one of the greatest of our industries. I wonder if I might just epitomize the state of the bituminous industry during the calendar year of 1957 and its relationship to the national economy and to the public interest.

COAL—WHAT IT MEANS TO OUR ECONOMY

First, during the year 1957, the value of bituminous coal, F.O.B. mine, was \$2.5 billion.

This provided wages and salaries of about \$1.5 billion paid to 240,000 workers. Counting workers and their dependents, one million persons were directly benefited.

It provided supplies, power, and equipment purchased of over \$500,000,000, giving employment for thousands in the manufacturing industries.

It provided nearly \$500,000,000 for local and Federal taxes, advertising, and other expenses and profits. The latter helped finance new construction, of more than \$100 million.

The shipment of coal from mine to market added \$2 billion to the revenues of railway, waterway and highway transporters, which in turn gave direct employment to 200,000 workers and indirect employment to other thousands.

Coal processed in coke plants and handled through retail yards added another \$500,000,000 in wages directly for 100,000 coke and retail workers.

In total, the bituminous coal industry directly added \$5 billion to national income and employment for 600,000 persons. More than two million workers and their dependents are benefited. Indirectly, the industry adds much more to national income and employment, supporting the economies of mining regions, generating activity among mining equipment and supply manufacturers, and furnishing profitable traffic to transporters.

Approximately 84 percent of the United States fuel resources consists of its identifiable coal deposits. In the realm of natural resource values, they constitute our greatest heritage.

BUT IT IS "TAKEN FOR GRANTED"

And yet, members of the American Mining Congress, there is no industry in the United States that is so taken for granted to such a degree by the government as the coal industry. It is taken for granted, accepted as a matter of course, left to its own resources, without aid or reasonable assistance in expanding its markets, or overcoming its scientific problems of research and experimentation.

There has been no particular or efficient effort made to find world markets that will insure generations yet to come of receiving great values from this natural resource which Providence and a bountiful nature bestowed upon us.

In two World Wars, cataclysmic in their potentials—as far as the American republic is concerned and as far as the future of Americans was concerned—the coal industry has performed two remarkable tasks.

In World War I, which is now remote, the mining industry of this country, on its own resources, without government subsidy, without cost to the American taxpayers, expanded its production to the point essential to meet all of the internal requirements of this nation while at war and to make up the shortages in the countries of our allies by furnishing the coal that they themselves were incapable of producing. To do so, vast sums of new money had to be invested in the industry, development and construction of great magnitude went into effect.

And with the close of World War I the industry was left with an excess productive capacity and some 200,000 idle men for whom there was no employment. So, then came the long fight through the ensuing years by the investment side of the industry to keep its head above water and by the manpower of the industry to find ways and means of keeping the breath within their bodies and their souls alive.

So, we had the economic agony of the industry all through the '20's—those long years of internal convulsions in the industry, continuing losses for investing capital, the constant selling of the assets established in the industry during the war period. I recall that during that period from 1925 to 1932, a seven year period, one coal company of some magnitude in this country in the bituminous industry reduced its assets to the extent of \$35,000,000 of invested money—\$5,000,000 a year lost for seven years continuously. And that was symbolic of the rest of the industry.

During the years that followed 1932, we struggled uphill, trying to rehabilitate and revamp this stricken industry, trying to put thousands of coal companies on the right side of the ledger and trying to establish a wage in the industry that would permit mining families to live somewhere near the standards that Americans

should expect. And while we were in the midst of that effort, World War II ensued. And again the story was repeated. The industry was called upon to furnish coal and to furnish coal in increasing quantities and volume. Millions and millions of dollars in new investment were poured into the industry for development and construction. And to the everlasting credit of the men in this industry—the management, the engineers, the technicians, and the mine workers—with 300,000 less men in the industry than had been the case in World War I production was expanded to 125,000,000 tons more than had been achieved in World War I. An unparalleled history of free enterprise standing alone!

With the end of World War II, and in the brief period that succeeded it, we were again left with an expanded productivity—in sense of requirements—of about 240,000,000 tons and with surplus manpower to the extent of about 200,000 men trained in the industry, skilled in their vocations, capable of producing coal in greater quantities than is possible in the mines of any country in the civilized world.

Did our government do anything to preserve the stability of this industry, or try to keep that investment intact or try to keep that trained and skilled manpower available, either for the benefit of our economy or as an assurance against destruction in the next war comes along? There was only carelessness, ineptitude, indifference, virtual contempt by the administrative bureaucrats of the government! And I am not speaking merely of the Republican administration; I'm speaking of the Democratic administration that preceded it.

There are no politics in this situation as far as the mining industry is concerned. All other nations of the world value their coal deposits and their ability to produce coal. All other nations of the world regard coal as a natural resource to which future generations shall be heir. And they do something to preserve and expand their industries. During the last couple of years, if war had occurred the American coal industry could not have served the nation well because our transportation system in this country could not have carried the coal to market—again through governmental neglect.

RUSSIA FORGING AHEAD

Russia will this year exceed, in actual tons of production, the production of coal in the United States. That, for the first time in history. Since 1952 the Russian coal production has been expanding at the ratio of 10 percent per year. Since that date our industry has expanded at the rate of $\frac{1}{2}$ of 1 percent per year.

Russia has a "crash" program, as you know, of expanding her produc-

tion 265 million tons more by 1960. They contemplate opening 265 modern mines, modern according to the Russian standards. They have blocked off recently a new coal field—the so-called Karaganda Basin east of the Caspian Sea—where the resources are estimated to be 52.2 billion tons of more or less high grade coal, available for coking and metallurgical purposes—a tremendous offset to the 30 percent lignite which is compounded into their annual production.

What does it mean? It means that Russia is drawing more on research, experimentation, and actual development and installation than the United States. Why? Because it is pursuant to the declared policy of the Russian government.

It's a reasonable assumption—and the weight of logic would cause one to conclude—that Russia doesn't want a killing war with the United States. They have no desire to commit mass hari-kari or national suicide in that kind of war because they don't believe they have to resort to war to gain the economic objectives which they proclaim and declare, and which they are pursuing diligently. In November, Khrushchev said in part:

"We declare war upon you in the peaceful trade field. We declare a war we will win over the United States. The threat to the United States is not an ICBM but in the field of peaceful production. We are relentless in this and we will prove the superiority of our system."

COAL AS A WEAPON

So, Russia wants more coal to barter in the world markets, in mass volume, to displace the world markets of American coal. Russia is moving to eventually gain control of the oil deposits in the Arab states—and she is moving effectively. As she concurrently develops her coal industry, she will eventually get to the point where she has an excess, exportable in world markets over the consuming needs within the Russian empire.

With economic control over that coal and political control over Near-Eastern oil, her position in the world of barter will be improved to such a degree that the United States will be continuously at a disadvantage unless we protect ourselves and unless the government of the United States finally comes to the conclusion that it is essential to protect the fuel resources of the United States and the so-called Western nations from economic exploitation by the mass productive powers of this spreading octopus that threatens our way of civilization.

Will they barter? They are already doing it! With whom? Why with our beneficiaries and our allies, speaking in a national sense.

In the month of March this year Japan concluded with China a \$568,000,000 barter deal. Japan will receive

coal from China and in return will give coal, steel, finished articles and soy beans. And, in consequence, there won't be so many coal ships loaded for Japan from our coal ports as heretofore has been the case during these years from World War I, and during which period we have been putting from \$500,000,000 to \$1,000,000,000 a year total expenditures into the economy of Japan.

Incomplete reports from the United Nations, in their February issue of the Directory of International Trade, covering from two to 11 months of 1957, give these interesting figures: that the British Commonwealth of Nations has traded \$1.242 billion in 1957 with the communist nations; France, \$251,000,000 — and France with her Algerian war is virtually dependent upon the United States; other colonial powers, \$157,000,000; free nations—non-colonial—in Africa, \$274,000,000; Latin-American nations, \$89,000,000; Asian free nations — non-colonial — \$453,000,000; European free nations — non-colonial, \$1.832 billion. This is \$4.301 billion worth of trade with the enemy in 1957 on a partial report.

Since World War II, United States has spent \$53.236 billion in military and economic aid. Of this amount \$34.761 billion was in economic aid—to put the countries which are now trading with the enemy in a position to do so.

We knock 'em down and we build 'em up. And, when we have them built up, it's almost to the point where they should be knocked down again if we follow the reasoning that existed in the first place.

I'm not sure but what if Russia wants to return East Germany to Germany so that Germany could become a united state again. The economic advances a restored Germany would make during that period would cause her to be a menace to the economy and banking business of Great Britain. And she may declare war on Germany again as she has twice before.

This is the second time we've built Germany up after destroying her. What I'm worrying about is can we build her up again after we have to destroy her once more.

These are absurdities, of course; but I ask the question: will these countries barter with Russia and the communists? They will, on the record! Now certainly, Russian coal cannot on its merits undersell American coal in the world markets. This is providing, however, that our industry and our government follow a sensible course of preserving the productive capacity and the markets for this industry on the basis that it can compete when the time comes. And the time may come any time!

If Russia extends her political

sphere of influence over the Arab nations in whole or in part, and the whole will eventually follow the part, how is she going to market her coal? The coal from the Donets Basin and the Ukraine deposits can be loaded on the Black Sea. The coal from Karaganda Basin can be loaded on the Caspian, into which the Volga flows with access to the interior of Russia for any domestic consumption they want. And it's only about 500 miles overland across Iran from the southern shores of the Caspian Sea to the headwaters of the Persian Gulf.

The Czars for centuries dreamed of a warm water port for Russia on the Persian Gulf. Does anyone think that the communist leaders of Russia are not now dreaming of it? And who does not believe that the day will come when the government of Iran will be glad to make arrangements for modern railways or modern canals over part of that terrain?

And the Persian Gulf will be just as accessible to those coal fields as Hampton Roads is to the coal fields that abound Cincinnati!

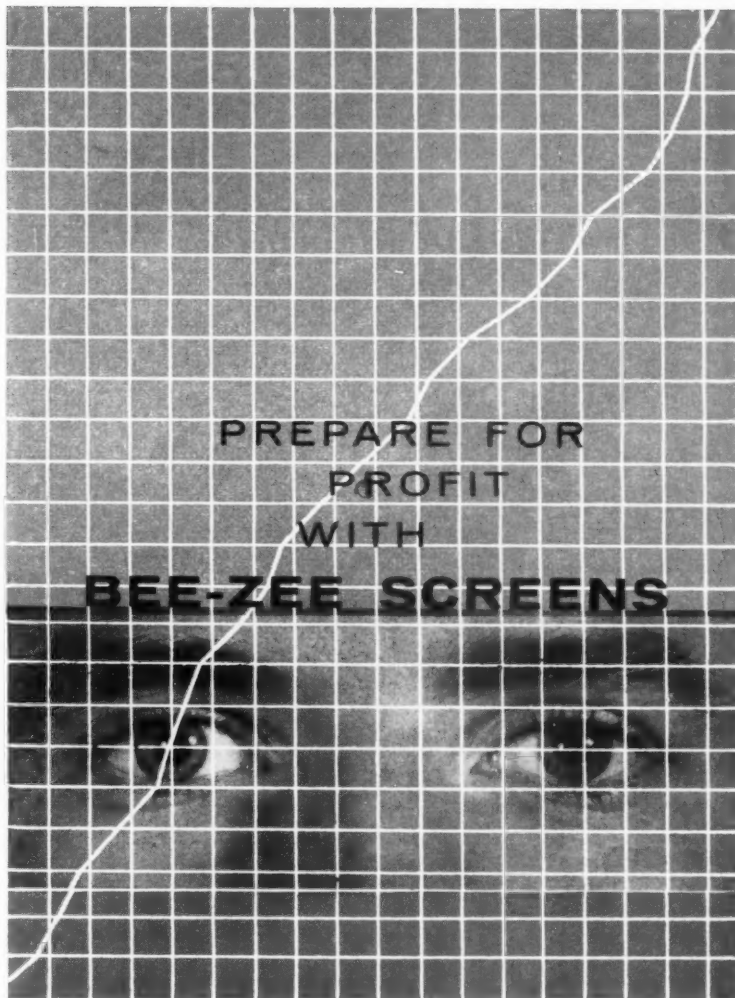
GOVERNMENT RECOGNITION NEEDED

It is essential that our statesmen and our economic leaders in this country look forward and appraise the potentials of tomorrow because an industry of this magnitude cannot be turned about in its course if the weather changes, or the country should suddenly decide it wants millions of tons more of coal.

The current shutting down of many mines since January 1 is a discouraging thing in this industry. It is discouraging because the young men trained in the production methods of those mines are not prone to stand idly by and starve. They go elsewhere and they are lost to the industry! And the industry has an investment in them; and their productive capacity is high. And the genius of young men is great. But they are lost to the industry under this dog-eat-dog competition in the mining industry. And the losing of them runs to the question of cost and the question of return on capital investment. Trained men!

Do we do anything about it? No! We haven't been able to get reasonable protection for our industry from the government in the matter of imported residual oil contrary to all the false promises that have been made month after month for some years now—a shying away from the responsibility of facing the question. Our industry needs better protection in its depletion allowances. I have felt that our industry has been too modest about making the request for an extractive industry, the values of which disappear with continued operation of plant and equipment.

(Continued on page 69)




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1958 COAL CONVENTION REPORT

INTEREST in the present and future status of the coal mining industry waxed high at Cincinnati, Ohio, May 5-7, during the 1958 Coal Convention of the American Mining Congress. Well over 1800 mining men were present to take part in the general and technical sessions of the three-day meeting which fully covered the outlook for the coal industry, and operating problems in both deep and strip mining and coal preparation.

A highlight of the Convention was the address by John L. Lewis, president of the United Mine Workers of America, at a special luncheon on Monday, May 5. In the first address he has ever made to the American Mining Congress, and one of the major speeches of his career, Lewis spoke to a sell-out luncheon audience of over 1000 coal mining men, plus an overflow crowd of several hundred more who listened to him from another room. Mr. Lewis complimented the American Mining Congress "for the advanced position it takes on the problems of the industry, and its studious and scholarly approach to many of the industry's highly technical questions."

In outlining the tremendous value of the American coal industry to the nation's economy, he said, "The bituminous coal industry directly added \$5 billion to the national income and employment for 600,000 persons, benefiting more than 2,000,000 workers and their dependents." He added that 84 percent of the U. S. fuel resources consists of the nation's identifiable coal deposits.

In two World Wars the American coal industry has literally saved the nation and its Allies from defeat, Lewis went on to say, and then warned that, while the American Government is neglecting its most basic industry, the Russians are engaged in a "crash" coal production program and have been jumping production by 10 percent a year. Meanwhile U. S. coal output since 1952 has expanded at the rate of only one-half of one percent a year.

The complete text of the Lewis address is carried on pages 55-57 of this issue of MINING CONGRESS JOURNAL.

Lewis was introduced by George M. Humphrey, chairman, National Steel Corp. In his introductory remarks,

Humphrey, former Secretary of the Treasury, reviewed the almost 40 years of acquaintanceship he has had with Lewis. He said that during all that time he has had a growing admiration for Lewis, who has manifested a respect for individual freedom, respect for competitive enterprise and respect and devotion to the United States of America.

Humphrey went on to say, "He has been a friend of coal . . . We have often differed on the detail as to how you would reach an objective. But, as you look back in retrospect, he has been a great friend of mining and particularly of the coal business."

"He joined with us in the attempt to minimize the bad results of difficult importations. He has joined with us in attempting to increase beneficial exports. He joined with us in trying to promote research. He joined with us in the promotion of safety . . . above all, he has done one thing and one great thing that is of great benefit not only to this business but to the whole United States and all industry in this country."

"Back in the early days, when many,

many unions were basing their programs on the idea of decreasing production, limiting of activity and decreasing ability of the individual, John Lewis stood then as he stands now and has all of the time for the improvement of the individual and increase of individual productivity. . . . And it is the development of individual productivity that distinguishes us and our industrial system from all the rest of the world.

"We have two hands and what our two hands can do—just our two hands—is little better than the two hands of a savage. But the two hands of an American do 20, 40, 100 times as much as the hands of any savage, and they do it for one reason. They do it through mechanization, through the use of power, through the placing of organization and development in those two hands. And through that increase of individual productivity America has grown and that is the basis of our industrial strength. In all of that this man has helped this industry; so that this industry in America stands above like industries everywhere in the world."

L. C. Campbell, chairman of the AMC Coal Division, presided at the Lewis luncheon.

CONVENTION PROGRAM

The technical program arranged by the National Program Committee under the chairmanship of James C. Gray, administrative vice president—Ray Materials, U. S. Steel Corp., was outstanding. Each paper was presented by a recognized expert in his field, many of them younger members of the industry.

A review of each convention paper is carried on the following pages.

The Convention was officially called to order Monday morning, May 5 by Gray, who paid tribute to the hard-

working Program Committee for their efforts in putting together this year's fine program. Referring to the theme of the Convention, "Research for Progress," he remarked that he felt all in attendance would agree with an age-old quotation, "That man is in the right who is most closely in league with the future."

Howard I. Young, president, American Zinc, Lead & Smelting Co., and president of the American Mining Congress, extended a welcome to the Convention on behalf of the AMC Board of Directors, and expressed their sincere appreciation for the co-operation of the coal mining industry and coal mining equipment manufacturers in the work of the American Mining Congress. He paid tribute to the progress the coal industry has made over the past 25 years, and said that it is the intense desire to do things better which has put the industry in the position that it occupies today. In referring to the present economic situation, Young said, "as long as we have faith in the future of the United States of America and as long as we don't have too much trying to get security instead of maintaining freedom, we're going to progress in the future as we have in the past."

The meeting got off to a running start with the opening address by the Rev. Dr. W. H. "Bill" Alexander, Pastor of the First Christian Church, Oklahoma City, Okla., who spoke on "The Human Side of Research." Dr. Alexander, urged his audience not to sit back and let the world go by. He said that the future of America rests on the businessman, and to fulfill the obligation placed upon him he must have faith in the future, adhere to the ideals that have made us the strongest nation in the world, and do his level best to keep our technology

advancing at an ever-increasing rate.

Dr. Alexander's stirring address inspired the Convention and set the tone for the rest of the week.

MANUFACTURERS DIVISION

On Monday afternoon the Manufacturers Division held its regular meeting with Jack H. How, president, Western Machinery Co., presiding.

Julian Conover, AMC executive vice president, reported on the activities of the Division during the past year and discussed plans for the future. He reviewed briefly the legislative situation in Washington as it affects the mining industry and manufacturers of mining equipment.

William E. Goodman, board chairman, Goodman Manufacturing Co., reported on a meeting of the Mining Machinery Industry Advisory Committee to the Department of Commerce held in Washington May 2. He reviewed the industry's cooperation with BDSA, and referred to the work done in 1955 by a Task Force of the Manufacturers Division in arranging for the collection of data on the consumption of steel, copper and aluminum in the manufacture of mining equipment, thus putting the industry in position to obtain prompt allotments of critical materials in the event of an emergency. He pointed out that mining machinery is one of only half a dozen industries that have taken such action to protect their position and to avoid the protracted delays encountered on previous occasions. The report form originally adopted for this purpose, he said, has now been greatly simplified, calling for much less detail.

Goodman then outlined the successful efforts by the Manufacturers Division to obtain a separate "four-digit code" in the Census classification



Cross roads of the coal industry—the registration lobby on Monday morning. Over 1800 mining men gathered in Cincinnati to take part in the general and technical sessions



Three coal mining men of wide repute—(from left to right) George M. Humphrey, chairman, National Steel Corp.; John L. Lewis, president, United Mine Workers, and George H. Love, chairman, Consolidation Coal Corp.



The Annual meeting of the Manufacturers Division was held Monday afternoon

of industries—as a result of which the Census figures on mining machinery will be compiled separately and not combined with those for construction machinery as heretofore. This recognition of mining machinery as a major industry in its own right should be helpful in many ways, he said.

TUESDAY LUNCHEON

A second luncheon was held Tuesday, May 6, with chairman Jack How of the Manufacturers Division presiding. He introduced the chairmen of the various Coal Division Committees, who were seated at the head table. The featured speaker was Bob Feller, of baseball fame, who took the minds of his audience off coal mining matters by reminiscing on his experiences while pitching for the Cleveland Indians.

(Continued on page 69)

ABSTRACTS OF CONVENTION PAPERS

STRIP MINING— New Methods and Equipment

R. J. HEPBURN vice president, The United Electric Coal Cos., was chairman of the Monday afternoon session on Strip Mining.

The first speaker, Frank Gilbert, superintendent, River Queen mine, Peabody Coal Co., described a specially designed 55-cu yd shovel that has simplified the job of strip mining two seams of coal at the River Queen mine in western Kentucky. The shovel works from the surface of the lower seam and removes the overburden from the side, swinging approximately 180° to deposit the spoil. In addition it removes the parting by digging straight ahead of itself and deposits this spoil to the side. The principal advantages of the method as it applies to the River Queen mine are: (1) Maximum utilization can be made of the spoiling capacity of the large stripper, and (2) only one machine is required to perform the dual functions of stripping the two seams.

Gilbert pointed out that in order to accomplish this two-seam stripping job a machine had to be constructed with special features. A Bucyrus-

Erie 1650-B shovel with a long range front end was constructed and equipped with a new Amplistat electric control to speed up the digging cycle. The boom is 145 ft long, the dipper handle is 86 ft long, effective length, and dipper capacity is 55 cu yd. With the equalizing jacks extended three ft, the machine can dig to the side and strip a 45 ft wide cut exposing the top seam of coal without the dipper heeling. In addition the machine can dig a 96-ft radius of level floor at track level. Gilbert also discussed other phases of the operation, including the 1400 tph tipple. The full text of his paper appeared in the May issue of the MINING CONGRESS JOURNAL.

"Developments in Ammonium Nitrate Blasting" was the topic of the paper by Robert L. Akre, superintendent of drilling and blasting, The Maumee Collieries Co. According to Akre, virtually every operation in the coal stripping industry has tried, and is using in some degree, prilled ammonium nitrate as a blasting agent. After reviewing some of the trends and developments during the last year, he commented that the accumulated experience of users of AN-fuel blasting agents is now beginning to bring out not only the definite advantages of this material but its limitations as

well. The safety in mixing and use is well established. Advantages of premixing and of the package product have been demonstrated where careful supervision and attention to good blasting principles have allowed the properties of an explosives to be utilized to the utmost. Akre said that with further experience the advantages of higher density AN blasting agents will become more evident, particularly where hard shooting is encountered. Further experience, he added, will also show which are best primers to use—as to size, shape, and type of explosive, considering both economy and safety, as well as performance of the prill-oil product.

James Hyslop, president, Hanna Coal Co., Division of Consolidation Coal Co., described the Hanna ammonium nitrate blasting system. About two years ago the company inaugurated an extensive, scientific investigation of the whole problem of ammonium nitrate blasting, employing Combustion & Explosives Research, Inc. and Arthur D. Little, Inc. As a result of this program, Hyslop explained, Hanna has developed a system of blasting which is believed to be superior to any other system the company has tried. This system consists of using prills of proper speci-

fications coated with 0.4 percent of an anti-caking agent. Two mixtures of oil are used. A relatively small quantity of a two percent mixture is used as a priming charge, while the main charge consists of a six percent mixture. The charge is detonated with 60-grain, or smaller, Primacord. After describing the blasting system, Hyslop spelled out the results of tests made to check the method's effectiveness and safety.

A report, "Current Practices in Anthracite Stripping," was delivered by A. E. Coddington, vice president, Carey, Baxter & Kennedy, Inc. Coddington observed that for a number of years the anthracite industry has been annually obtaining a larger percentage of its production from stripping, or open-pit mines. The main reason for this trend towards strip mining, he said, is easy to find in lower unit cost of production. He discussed current practices and new developments in the stripping of anthracite that are helping to reduce cost and increase unit production. These are notably: (1) Use of ammonium nitrate prills or granules for primary blasting, (2) new blast hole drilling equipment and techniques, (3) larger and more powerful bulldozers, (4) front-end loaders and (5) the continuing trend toward larger equipment. These current practices, he said, are all factors in helping to achieve the lower costs that are necessary if anthracite is to maintain a favorable price differential in the space heating field, and to expand its potential markets in the industrial field. He emphasized that much of the success of strip mining in the anthracite region must be attributed to the willingness of operators and contractors to adopt new and more efficient equipment and practices, and to the manufacturers and suppliers who constantly strive to improve their products.

In discussing Coddington's paper, James R. Bazley, vice president, J. Robert Bazley, Inc., reviewed other practices that have contributed to lowering the cost of anthracite. Some of the topics he covered were pre-cleaning coal at the source, electric welding advances, two-way radio communication, more emphasis on preventive maintenance and using company-owned airplanes to facilitate the delivery of repair parts. In closing, he said that the price of anthracite must be kept within the reach of everyone by newer, bigger, more efficient and new types of equipment as well as new technological advances in stripping operations.

* * *

A SECOND session on strip mining was held Wednesday afternoon, S. F. Sherwood, president, Stonefort Corp., served as chairman.

A. D. Henry, general superintendent, Powhatan Mining Co., discussed "Continuous Mining from Strip Highwall." Henry said that in spite of the mammoth stripping shovels in use, most companies eventually reach a height where it is not economically possible to strip and as a result tracts of coal under high cover remain unmined. Much of this coal was considered of little value until a few years ago as there was no suitable way of recovering it.

In 1951 and 1952 a few companies started auger mining some of these areas and while the coal can be mined at a very low cost in this manner it is wasteful of the coal reserves. This waste and loss of deep coal reserves prompted officials of Powhatan to conduct experiments with continuous mining under highwalls that had been stripped to about 80 ft of cover at their Betsy Mine in Jefferson County near Bloomingdale, Ohio. Henry went on to tell how the pit was prepared for continuous mining, the equipment selected, and the mining plan used. He also presented cost and operating data and listed some of the initial difficulties that had to be overcome. At present, he said, the mine is producing an average of 360 tons per eight-hour shift, with a face labor cost of \$0.70 per ton. The full text of Henry's paper appeared in the April issue of MINING CONGRESS JOURNAL.

Five speakers representing firms that are using some of the most recently introduced haulage trucks discussed what is new with their particular piece of equipment and how it operates under field conditions in a Symposium on "Developments in Strip Mine Haulage."

The first speaker, Robert G. Bunch, partner, Bunch Construction Co., talked on his company's experience with Model L. R. S. W. Mack trucks. After reviewing haul road conditions, he described these short wheel base trucks which can carry 35 tons. Bunch said that trouble-free operation is accomplished by rubber-mounted springs, few greasing points and a good balance of component parts.

"Haulage Developments at the Enos Coal Mining Co.," was the subject of the next paper, given by William C. Laidlaw, production engineer, Enos Coal Mining Co. The Enos haulage fleet proved insufficient to meet a greater demand for coal because of time lost at an inefficient loading shovel and an ever lengthening pit haul. To remedy this situation the Enos management considered two possibilities: (1) The acquisition of additional loading and haulage equipment, and (2) increased utilization of present equipment by enlarging storage facilities. Careful analysis indicated that additional storage facilities could very well remedy the situa-

tion and provide other advantages; hence, an additional 3000 tons of storage capacity was constructed. Further advantages of the increased storage were derived by replacing six 44-cu yd tractor-trailer units with three new 61-cu yd White Motor Co. Autocar units. Laidlaw described new storage facilities and haulage units, and completely explained how they have reduced tippable downtime to a minimum.

Ernest W. Bruns, president, Bolt Mining Co., told how the versatility of modern coal hauling equipment made it possible for his company to establish a profitable operation under tough natural conditions. He explained that the coal is at an elevation of 2600 ft, while the railroad or delivery point is down in the bottom of the valley. The mine is about 850 ft above the dump and in rough country. Topography made it necessary for the company to gain this 850 ft of elevation in 2½ miles, giving them an average grade of 6.7 percent with pitches up to 7½ and 9 percent. He explained how haul roads were constructed and the performance of high capacity Euclid tractor-trailer units on the long steep hauls. He also commented on haulage techniques used to combat the many problems that arose.

Bruns pointed out an interesting side light in the operation—a deep mine operated in conjunction with the strip mine. In discussing cost of hauling coal, he noted that the rapid decrease of production during the winter months is reflected in a fast rising cost, pointing out the necessity of developing further techniques for winter operations that will keep production high and hauling costs down. He concluded that as hauls get longer the application of the high capacity off-highway coal hauler becomes still more important to the coal industry.

Lowell E. Copeland, president, Beckley Coal & Coke Co., pointed out that his company is not using large haulers on stripping but is instead hauling coal from underground mines. Of course, he added, they can easily be adapted for strip mine haulage if so desired. He described three large haulers—one Kenworth-Marion combination and two Darts. All three are bottom dump design of similar size and have many features that are similar, if not identical. Since conversion to these large haulers, he said, the company has reduced its hauling cost 80 percent over conventional tandem trucks, and 35 to 40 percent over 25 to 40-ton bottom dump haulers, with very little difference showing in road requirements. In summing up, Copeland said these large haulers seem to be very practical, not only for hauling from underground mines, but for strip mines haulage as well.

The last speaker of this Symposium, Martin R. Heckard, superintendent,

Rapatee Operations, Midland Electric Coal Corp., described his firm's mine in central Illinois. Since the land is relatively level, Heckard said, the haulage problem consists of lifting the coal from the pit to the top of the surrounding countryside, and hauling it into the plant on high speed roads. After a brief description of the roads, Heckard described the mine's new coal hauler which can carry 80 tons of coal. He pointed out that the company was interested in carrying the greatest pay load with the least possible empty weight. This unit gives the mine $2\frac{1}{2}$ lb of payload to each lb of empty vehicle weight. The coal hauler is manufactured by LeTourneau-Westinghouse and sold as their Model L. W. 80.

UNDERGROUND POWER— Plan for A-C Operation

ON Monday afternoon the Underground Power session was held under the chairmanship of George L. Judy, vice president, Mountaineer Coal Co., Division of Consolidation Coal Co. Wm. F. McAllister, Russell Fork Coal Co., was the member of the Floor Committee assisting.

C. R. Huffman, staff electrical consultant, Donegan Coal & Coke Co., discussed "Factors in Evaluating and Selecting A-C Power Systems for Underground Coal Mining." In outlining the major considerations in choosing an a-c power system for underground application, Huffman commented on the three broad advantages of a-c power over d-c power for face equipment—namely, the a-c system is inherently safer, more economical and has higher reliability. He considered overhead and underground power supply systems, selection of service voltage, voltage regulation, mine power cable, substations, transformers, use of neutral ground wire in a-c systems, and oil circuit breakers. The safety aspects of a-c were stressed throughout the talk.

In discussing Huffman's paper, David E. Hamilton, application engineer-mining, General Electric Co., pointed out the importance of closely studying voltage regulation, not only under normal operation conditions, but also under conditions where individual pieces of equipment would be started up. The surge of current demanded by an a-c motor on start up is a limiting factor that should be fully understood. He went on to predict a gradual swing to a 6.9-KV distribution voltage from surface to the face load center and then discussed the safety features of various a-c systems.

According to John A. Stachura, general superintendent, Enoco Collieries, Inc., the lifeline of any coal mine today is its electrical distribution system. In his talk, "Selection of A-C Distribution Equipment," Stachura

said that the numerous safety and economical features included in today's 440 volt a-c face set up and 4160 or 6900 volt primary voltage is a challenge to all states which prohibit or restrict its use by obsolete mining laws. "Our experience with a-c equipment," he reported, "has definitely proven that there are advantages with respect to lower initial cost, less maintenance, greater flexibility, increased efficiency, and improved safety to all personnel." He went on to discuss a-c high voltage lines, secondary cables, fault finder, transformers, and a modern a-c section layout. In summarizing, he stated that cooperation between management and manufacturer, close study of existing installations, and research can continue to stimulate the advancement of a-c mining.

The final paper of this session, co-authored by J. H. Sherrard, Jr., chief engineer, and Andrew Rusnak, maintenance supervisor, Johnstown Coal & Coke Co., was presented by Rusnak.

COAL PREPARATION— Fine Coal and Future Markets

SESSIONS on Coal Preparation were held on Tuesday and Wednesday mornings. Robert Llewellyn, preparation engineer, Eastern Gas & Fuel Associates, was chairman at the first session with F. Earl Snarr, Freeman Coal Mining Corp., serving as Floor Committee member.

First paper of the morning was given by M. C. Chang, research mineral engineer, Research Department, Crucible Steel Co. of America, who had as his subject, "Fine Coal Preparation and Closed Circuit Operation." The Crucible Mine, located at Crucible, Pa., has a production capacity of 5000 tpd. Chang described the coal preparation plant which has a rated capacity of 400 tph and consists of hydroseparator boxes to wash the coarse coal, and hydrotator units, with a classifier concentrator, to process



Meetings were well attended

He described the a-c power system of the Crichton No. 4 mine in Nicholas County, W. Va. Reviewing the company's experiences with d-c and a-c, he said that a-c power in his firm's surface system provides for simplicity of installation and repair, a minimum of supervision, and a marked cost decrease in comparison with the d-c systems. In face operation Johnstown Coal & Coke has realized definite advantages in maintenance, both in the number of electrical failures and in the cost of those that do occur, with a-c power. Preventive maintenance requirements are not as great as in the firm's d-c systems. Repair and examination work is greatly simplified and does not require the degree of skill and training required for d-c power personnel. Rusnak concluded that the most advantageous power system available to the mining industry today in installation, operation, and maintenance is one providing three-phase, 60-cycle alternating current, with a minimum phase to phase potential of 440 volts.

the minus $\frac{3}{16}$ -in. coal. Prior to the changes which resulted in the present circuit, the fine coal slurry was recovered by processing it through a battery of five 14-in. and one-hundred ten 3-in. Heyl & Patterson cyclones in parallel with a 75-ft Dorr thickener. Two-thirds of the volume went to the cyclones and the remaining one-third to the thickener. The underflow from the cyclones and thickener were filtered, respectively, in one 12-disk Eimco and two 4-disk Oliver filters fitted with stainless steel cloth. The resulting filter cake was added to the coarse metallurgical coal. The overflow was recycled to the coarse coal section of the plant.

To facilitate the processing of fine coal slurry and to improve the performance of the coarse coal circuit, Chang explained, numerous changes were made in the plant. These changes, which he fully described, included the wet classification of minus ten-mesh coal by cyclones, beneficiation of the minus 28-mesh cyclone

underflow by flotation, flocculation of thickener feed to provide clear water for recycling, and the disposal of the fine refuse as cake by filtering the thickener underflow. He also detailed the results that were obtained.

Control of solids in the circulating water is a major problem confronting plant personnel where wet cleaning methods are being used, according to J. J. Reilly, coal preparation superintendent, Vesta-Shannopin Preparation Plant, Jones & Laughlin Steel Corp. Reilly, in his discussion, "Benefits of Reducing Circulating Solids," went on to say that if the solids are allowed to build up, the entire circuit gets out of control and the uniformity and quality of the product are adversely affected. He cited the Vesta-Shannopin plant as an example to illustrate this and told what the company did to reduce circulating solids. "In our plant operation," he commented, "much emphasis is placed on circulation of the minimum gallonage of water, and the company has made an effort to reduce the solids in the water to a minimum." He observed that the economics in each plant must be studied to determine the method that can best be used to obtain maximum recovery of useable coal at the lowest possible price.

Paul Levin, project engineer, Allen & Garcia Co., presented a paper, "The Pumping of Solids in Coal Plants." As the number and size of plants for the wet preparation of coal increase, the opportunities for employing pumps economically become more widespread and varied. Levin listed the advantages of pumping, as compared to other methods of transporting solids, as the comparatively low initial cost of pumps and pipelines and the convenience and ease of making the pumping installation. On the other hand, he said, it must be pointed out that pumping generally consumes more power, and the maintenance cost of pumping is frequently higher. The choice between pumping and other means of solids transportation is more often than not dictated by the physical state of the material to be moved. Types of pumps available, factors in design of a solids pumping system, and pipelines for the transportation of solids were some of the topics he covered. In discussing maintenance of solids-handling pumps and pipelines, which can be a major source of cost in a coal plant, Levin stated that they can be minimized by proper design and an effective maintenance program.

"Recent Advances in Coal Thermal Drying" was the subject of the final paper. It was presented by F. R. Zachar, consulting mining engineer, Morgantown, W. Va. He stated that the cost per ton of thermally dried coal is now considerably lower, on the average, than it was not too many

years ago. He listed the characteristics necessary in a good drying system and discussed new methods and equipment. Zachar pointed out that thermal drying equipment manufacturers are endeavoring to provide the industry with high grade, low maintenance, highly efficient equipment to help the operators better satisfy their customers.

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WILMOT C. JONES, vice president, Jeddo-Highland Coal Co., presided at the Wednesday morning session on Coal Preparation. H. E. Mauck, Olga Coal Co., assisted as a member of the Floor Committee.

Labor required to handle railroad cars at Peabody Coal Company's River King, River Queen and Victoria mines has been reduced through automation of the tippie car hauls, according to George H. Morris, preparation engineer, Indiana Division, Peabody Coal Co. In his paper, "Reducing Coal Preparation Costs Through Automation," Morris told how railroad car handling and loading at each of the three mines is mechanized to make the loading operation as automatic as possible. He stressed that the car haul at each mine has reduced preparation costs, improved the quality of the coal and improved safety. In discussing each mine, he covered car haul equipment, layout of the tracks, loading control towers, railroad service and equipment, and weighing of the coal.

"Advances in the Art of Dense Media Cleaning" was the subject of the next paper which was presented by Emery Milligan, preparation manager, Freeman Coal Mining Corp. In describing the new techniques in using this method of coal preparation, Milligan commented on the fact that dense media cleaning has been brought within the means of all coal operators, large or small. He also discussed a process that promises a great future in the American coal industry—the comparatively new application of cyclones to dense media cleaning of fine coal. A true gravity separation takes place within the cyclone itself with this system. Material ranging in size from $\frac{3}{4}$ -in. diameter down to 35 mesh can be effectively cleaned at the feed ratio of 50 tph per 20-in. diameter cyclone. This process was developed in Holland and there are now several successfully operating plants in Western Europe and the British Isles. Of particular interest was the data that Milligan presented showing the operating efficiency of several dense media plants. In addition, he discussed the automatic specific gravity control circuit with the use of diptubes.

R. H. Wolin, assistant chief engineer, Combustion Engineering Co., Inc., followed with a paper entitled

"A Prediction of Future Demands by the Electric Utility Industry in Coal Quality." Wolin stressed that a large, expensive, efficient steam generating unit is only as good as its availability. Its over-all efficiency is greatly affected by operating and maintenance costs, and the quality of the fuels burned has a great influence on these items. He said that utility and industrial companies are looking more and more closely to the over-all cost of coal in terms of cost per pound steam generated rather than in cost per ton delivered to the plant. It should be recognized, he said, that upgrading coals must be looked at more and more intensely by everyone concerned. He discussed in some detail the components of the steam generating unit which are affected by coal quality. The full text of his paper appeared in the May issue of MINING CONGRESS JOURNAL.

Final paper on the Coal Preparation session was presented by Ray McBrien, director of research, The Denver & Rio Grande Western Railroad Co. Subject of his paper was "Research on the Nuclear Irradiation of Coal for Use with Diesel Fuel. McBrien told how the Rio Grande in mid-1955 sent samples of crushed coal to Brookhaven National Laboratory for gamma irradiation. This laboratory reduced the coal into particles small enough to be successfully dispersed in fuel oil. Since the Btu content per pound of coal is about the same as that per pound of fuel oil, the lower cost of coal can make possible a considerable price advantage favoring a mixture of coal and fuel oil. He explained that all this work is still in an experimental stage, and that the Rio Grande Research Department is continuing basic research on the problem. He stressed that this is a research project which the railroad company feels offers great promise for the development of solid fuels such as coal for use in almost any type of internal combustion engine.

SAFETY—

An Engineering Approach

RALPH E. KIRK, consulting engineer, Birmingham, Ala., presided at the Tuesday morning session on Safety. Birch Brooks was floor committeeman.

"Mine Lighting Developments" was the title of the paper presented by Robert R. Godard, district electrical engineer, Frick District, Central Operations-Coal, U. S. Steel Corp. Godard reported on a fluorescent lighting installation in a continuous mining section at the Robena Mine. After reviewing the mining plan and equipment deployment in the section, he presented a quick run-down on this experimental underground lighting project. The lighting fixtures used

contained two 14-watt, T12, fluorescent tubes and were designed for operation from a 117-volt, 60-cycle source. Physically they are 16½ in. long by 5½ in. in diameter and weigh 19½ lb. Lights are installed in the section on the tight side of all conveyor headings and along the last block of the section supply track. Spacing is 40 ft in secondary working areas with 20-ft spacing being maintained in such primary areas as face, shuttle car roadways, conveyor transfer points and loading stations. Each fixture is supported by a spad hanger and "S" hook. Godard went on to discuss the effectiveness of this installation and some of the problems involved. He expressed the belief that better illumination can be a powerful tool in obtaining increased safety, higher productivity per man and more efficient utilization of personnel and material. However, he said, there appears to be a need for further testing under poorer conditions before an accurate evaluation can be obtained.

Donald B. Shupe, mine superintendent, Eastern Gas & Fuel Associates, spoke on his company's experience with flame-resistant belting. Confining his talk mainly to polyvinyl-chloride belts, Shupe not only considered the safety aspects of the use of flame-resistant belting but also attempted to include as much of the practical operating experience as possible. In describing the construction of the PVC belt at the Wharton No. 2 mine, he commented on the lighter weight, pliability, and the fact that ply construction has been eliminated. Although his firm has not had any of the PVC belting in operation long enough to be able to make definite statements as to its useful life, he said it is steadily becoming more evident that this type of belting will stand abuse well and will be safe and economical.

In non-technical language, Ralph M. Hunter, manager, Electrical & Mechanical Department, Rochester & Pittsburgh Coal Co., discussed how a properly engineered a-c system is safer than a d-c system, especially where large mobile machines are concerned. In his talk, "Safety Advantages in the Use of A-C Power Underground," Hunter pointed out that use of alternating current reduces hazards of mine fires, dust and gas ignition by electric arc, and gas ignition by face equipment. In addition, he said, the ready availability of proper voltage makes area lighting much more attractive. Some of the topics covered by this electrical engineer included: Capital cost of a-c installation; relative copper required for a-c, d-c loads; practical voltage for transmission circuits; equipment used in distributing a-c power; detecting ground current and trailing cables, and the advantages of a-c motors. He



The luncheon on Monday was a big attraction

observed that with proper engineering, installation and maintenance, companies can achieve not only more and cheaper production, but greatly improved safety as well. The full text of his paper appeared in the April issue of MINING CONGRESS JOURNAL.

The final paper of the session was presented by C. E. Linkous, director of safety, Island Creek Coal Co. Among the case histories cited in this report entitled, "Rock Dusting in Multiple-Shift Operations," were rock dusting in triple shift operations utilizing off-track mechanical equipment, double-shift operation utilizing mechanical equipment on track, and a double-shift operation in thin coal where mobile equipment was used with belt haulage. In describing the three different methods of dust application, Linkous pointed out that hand dusting, although still practiced to a large extent, is slow and costly. Machine dusting with a conventional distributor which applies the dust dry is the most widely used method and is cheapest from both the quantity of dust required for full protection and the cost of application. The third method is to apply the dust in a slurry form on shift without interrupting regular operations.

Linkous explained that the method of rock dusting in multiple-shift operations is affected by number of shifts and type of mining. The problem is greatly simplified in double-shift operations as, except for the hand dusting of crosscuts which hole through during the production shift, a high-pressure machine can be used to apply the rock dust on the off-shift. The real problem, he said, is presented by triple-shifted sections and mines and/or where the face or faces advance more than 40 ft in two consecutive coal producing shifts. This problem is particularly acute where continuous mining machines are used. In summing up his talk, Linkous pointed out that adequate rock dust-

ing and safe operation of a mine is the responsibility of local management and they must, by necessity, take a personal interest in and devote considerable time to this phase of modern coal mining. The full text of his paper appeared in the May issue of MINING CONGRESS JOURNAL.

HAULAGE— Eliminating a Bottleneck

TUESDAY afternoon, Haulage held the attention of convention goers in South Hall. Wm. A. Gallagher, vice president, Stonega Coke & Coal Co., served as chairman of the session.

First paper of the afternoon was given by A. L. Lee, manager, Lee Engineering Division, Consolidation Coal Co., who had as his subject, "Recent Developments in Shuttle Cars." Lee described the latest developments in shuttle car design, covering a-c, d-c and diesel types. He listed the advantages and limitations of the three types and discussed the development of a shuttle car which in a given weight classification can be powered with a single diesel engine, a-c motor or d-c motor without substantial alteration of the basic gear train or power transmission equipment.

Combination haulage has been the answer to the need for efficient transportation under a variety of conditions at several operations. C. Ward Padgett, general superintendent, Southern Illinois Division, Bell & Zoller Coal Co., described one case of combination belt and track haulage at the firm's Buckhorn Mine near Johnston City, Ill. At the present time, this mine is operating both conventional and continuous mining units where the coal is hauled from the mining units to panel belts and discharged from the panel belts into mine cars. It is then hauled to the slope bottom in trains pulled by 22-ton electric powered locomotives.

There it is discharged into a 2000-ton surge bin and conveyed 1480 ft on a 15° 30' slope to the preparation plant. Although the combination of belt and track haulage at the Buckhorn Mine has been highly satisfactory, Padgett pointed out that, when selecting the most economical transportation system, the final choice can be made only after intensive study of the individual characteristics of the particular property in question.

The next speaker, Mack H. Shumate, assistant general manager, Truax-Traer Coal Co., also discussed combination belt and mine car haulage at his company's mines No. 7 and No. 8 at Eunice, W. Va. The mining plan calls for high capacity haulage system, using a shuttle car-belt conveyor-mine car combination, and provides for the development of main entries utilizing belt haulage discharging into mine cars at a common point with the belt from room entries. Shumate described the equipment used and showed how combination belt and mine car haulage facilitates the extension of haulage during rapid development and extraction between high-capacity equipment. He commented on the fact that belts also permit the mining of a considerable area, the tonnage of which is dumped at a single point, therefore reducing the number of loading points and side tracks necessary for efficient mine car service. He added that these loading points also provide a more uniform loading of mine cars, giving the coal operator the fullest efficiency of his equipment. The operating condition of these two mines was anticipated to the degree that the company was able to incorporate methods which had been developed at its older mines of employing intermediate belt haulage.

A discussion of mine car replacement at the Wheelwright and Price No. 1 mines, coauthored by E. M. Pace, general superintendent and E. H. Roberts, chief mining engineer, Inland Steel Co., was presented by Pace. In making a study valuation for replacing the old cars with larger and more efficiently designed units, the following factors were closely examined: Life of mines, amount of old workings, distances, tonnages, speed and size of trips, weighing and dumping facilities, power requirements, basic mining plans, size and design of cars, capital investment required and anticipated realizations from making the change. Major items of cost received close scrutiny. Major benefits for acquiring a larger and more flexible mine car were thought to be: Added safety, greater pay loads per trip, reduced track cleaning, reduced car maintenance, fewer wrecks, faster haulage, more rapid couplings, reduced lubrication costs and less car change time on production sections.



Fine food and entertainment marked the banquet Wednesday night

The new mine car adopted was an eight-wheel, 24-in. high, 262-cu ft capacity unit with automatic couplers. Pace presented a comparison of the old and new cars and described the preparation work done so that a smooth transition from the old to the new could be accomplished. At the current rate, he said, the company's investment will be returned in 2½ to 3 years. Over-all benefits amount to a 33 percent reduction in haulage cost and a five percent reduction in over-all mining cost figured in the railroad car.

"An Operations Research Approach to Mine Haulage" was the topic of the next paper by Ernest Koenigsberg, head, Operations Research Section, Midwest Research Institute. Operations Research, which might be defined as the application of scientific methods to the solution of business problems, has thus far found few applications in the American mining industry. Scientific methods and techniques show promise of solving some important operating problems and can aid in the more efficient use of existing equipment. Koenigsberg cited an example in which he reviewed a haulage system and analyzed it in terms of operating cycles, each with its own characteristics. Thus face haulage, intermediate haulage and main line haulage can be combined into a single mathematical representation which feeds mine operations as a transport and a transfer system. He illustrated the value of such a model by several typical examples.

In discussing Koenigsberg's paper, Oscar D. McDaniel, manager, Industrial Engineering, Old Ben Coal Co., described an actual example in the area of mine haulage whereby management, to avoid expensive errors, pursued the timid but tedious path of one change at a time to decrease production delays. The study and development of a new system covered the better part of two years. Many hours and days of system analysis were involved at an undetermined cost. To

this must be added the price of experimental mining of the trial application. Sometime later, the operations research technique was applied experimentally to the same problem by Dr. Koenigsberg and coworkers. The developed solutions, although similar in conclusion, stimulated considerable thought in the minds of the industrial engineering department. Several interesting variations existed when the two solutions were compared. McDaniel went on to point out the reason for these variations and concluded that Operations Research techniques are applicable to his company's haulage problems.

CONTINUOUS MINING— Continues to Grow

SESSIONS on continuous mining were held on Tuesday and Wednesday afternoons. Chairman J. L. Hamilton, executive vice president of Island Creek Coal Co., presided over the first session, and J. W. Krous, Imperial Coal Corp., served as Floor Committee member.

"Continuous Mining in Thin Seams" was the subject of the first paper, presented by W. J. B. Mayo, Northern Division manager, Eastern Gas & Fuel Associates. Mayo showed and discussed numerous slides on operating experience with continuous mining machines in low coal at three of his company's mines in Pennsylvania. In addition he briefly summarized the results obtained from these continuous mining machines under varied seam and mining conditions as compared with mobile loading.

Performance standards for continuous mining were discussed by Donald C. Howe, superintendent, Vesta No. 5 Mine, Vesta-Shannopin Coal Division, Jones & Laughlin Steel Corp. He pointed out that, during J&L's gradual move to continuous mining during the past eight years many problems involving roof control, ventilation, dust control, projection, and face transportation have been

encountered and have been handled with some degree of success. The firm's methods are now standardized in these particulars, although subject to change where it seems desirable.

Howe explained that in order to establish performance standards it is necessary first to standardize mining methods, mining projections and equipment to be utilized and to gain a large measure of control over maintenance. Each area presents its own problems, and too often a procedure that solves one particular problem may create difficulties elsewhere. Setting performance standards for continuous mining requires accurate knowledge of the loading rate of the miner under various conditions. This information can readily be obtained from time studies. What will prove equally important is an accurate analysis of downtime for various reasons, especially for repairs and for non-productive work such as timbering. Howe stressed the importance of keeping the methods used to set the standards as simple as possible.

R. L. Anderson, supervisory commodity-industry analyst—coal, U. S. Bureau of Mines, presented a paper on "Continuous Mining Productivity." Statistical data was given to show productivity of mines used in continuous mining equipment as compared to those using conventional equipment. Anderson pointed out that in recent years production by continuous mining has been increasing steadily while conventional mining by scraper and conveyors and by mobile loading in the mine cars has been decreasing. However, he added, mobile loading in the shuttle cars also has been increasing. The productivity of 24 mines, operating with continuous mining only in 1956, averaged 14.08 tons per man per day. The group of mines with the second highest productivity rate in this study was conventional mining—mobile loading into shuttle cars—which averaged 11.17 tons per man per day. Anderson observed that the total production of bituminous coal and lignite in 1956 was 501,000,000 and the average productivity for all mines was 10.28 tons per man per day. The full text of his paper appeared in the May issue of MINING CONGRESS JOURNAL.

Discussing maintenance of a-c continuous mining machines, LeMar T. Lindsay, shop foreman, Sunnyside Coal Mines, Kaiser Steel Corp., dealt with major areas of breakdowns encountered in nine years' experience by his company in the maintenance of continuous mining machines. At present ten continuous miners are in use at the Sunnyside Mines and are operated on a two-shift basis, averaging 250 tons per shift. Nine units are scheduled for operation and one for a complete overhaul in the outside

shop. According to Lindsay, company experience indicates a-c miners have about 50 percent less maintenance due to electrical and motor failure than d-c units. The a-c system is also superior to the d-c as a safety feature because of the quick acting ground fault relays on all face feeders, he said.

Gerald von Stroh, director of Mining Development Committee, Bituminous Coal Research, Inc., spoke on "Analysis of Service Haulage Behind Continuous Mining Equipment." After reviewing present practices and projections and considering the needs of the coal mine of tomorrow, von Stroh discussed potential systems of materials handling. For main line transportation, he described the Mining Development Committee's trolley conveyor which has a capital cost substantially less than mine cars or belts but is competent to handle 50 percent greater payload. The Committee's extensible belt would be applicable from the main line to the room entry or the length of the panel heading, he said. This system differs from those commercially available in that it has fewer moving parts. The first full scale unit will be extendable in 500-ft increments and is being designed for a total extended length of 2500 ft. Von Stroh also considered cableless shuttle cars utilizing gas turbines and internal combustion engines as a means of propulsion. In concluding, he presented a bird's eye view of what he thought the mine of the future might look like. The proposed system would produce 16,000 tons per shift for an investment of less than \$1.00 per annual ton of production.

* * *

P. P. FERRETTI, vice president, Pocahontas Fuel Co., Inc., was chairman at the Wednesday afternoon continuous mining session. The Floor Committee member was F. E. Williams, Jr., Pecks Run Coal Co.

Donald S. Kingery, chief, Mine Ventilation Section, U. S. Bureau of Mines, spoke on "Ventilation Problems in Connection with Continuous Mining Systems." After reviewing current methods of ventilation such as line brattice, exhaust fans and blowing fans, Kingery discussed the results of tests to determine the effectiveness of a small blower operated by hydraulic pressure and incorporated as a part of a continuous mining machine. Preliminary data indicates that the blower provides the added velocity necessary for effective face ventilation under gassy conditions. Of the tests made to date, the most promising from both ventilation and dust control appears to be the blower in conjunction with an auxiliary exhaust system with the tube end maintained close to the face. Kingery emphasized that the blower must not be depended upon to do the

job alone; enough intake air must be provided to dilute the liberated methane to safe limits.

G. C. Dyar, general superintendent of mines, Alabama By-Products Corp., presented a detailed account of what continuous mining has meant insofar as roof control is concerned at the Maxine mine. This is an all-belt operation and operates three shifts per day. Three continuous mining machines and five conventional mining sections produce 9850 tpd of raw coal. The roof and floor are firm, except in areas of thin cover where the roof is softened by the entrance of water. With the advent of continuous mining, Dyar said, some long established practices in roof control had to be reviewed. Some were discarded and others altered so that maximum production could be obtained with maximum safety and minimum cost. He explained how the Maxine mine has simplified its system of roof control to meet requirements of continuous mining.

"Planning for Continuous Mining" was the subject of a report by Jesse F. Core, vice president-Operations-Coal, U. S. Steel Corp. Core explained that the planning of any operation, mining or otherwise, must be given full consideration by all members of management. Careful inception of a mining plan entails objective cooperation by competent mining engineers, industrial engineers or their counterparts, safety inspectors, accountants, and alert, progressive operating personnel. He said that the end result of such cooperative effort must be a detailed layout incorporating sound engineering, efficient operating practices and improved working conditions particularly with respect to safety, and it must be presented in such a manner as to be perfectly understandable to the face supervisor who must properly execute the plan in order to attain the projected production and cost. Core went on to describe an actual case which had run the course of careful planning and objective execution with constant searching for improved methods, and enumerated some of the factors that are necessary for the success of any mining plan.

C. E. McWhorter, mining engineer, Goodman Manufacturing Co., described Russian developments in continuous mining. The speaker briefly summarized the contents of a British report that refers to continuous mining and loading equipment as developed and used by the Russians at the time of the British Technical Mission's visit in 1956, and expressed his understanding of the machines, commenting on their possible value for application to U. S. coal mines. McWhorter noted that, while the Russians had made great progress in developing machines for coal, they are

practically all for longwall application. In this system of mining, roof control is an important problem and the Russians are expending a great deal of time, money and energy in an attempt to mechanize roof control on long faces. He emphasized that it will be well for the United States to watch this phase of their development. They might come up with ideas for roof support that would control long face work with little labor. If they do, longwall mining could conceivably show an improved cost over our best room and pillar results.

In his discussion of McWhorter's paper, T. Reed Scollon, chief, Division of Bituminous Coal, U. S. Bureau of Mines, concentrated on hydraulic mining of coal in the U.S.S.R., describing installations, research work and productivity achievements. Under the current Five-Year Plan (1956-60), Scollon said, Soviet technical articles report that 69 underground hydraulic operations are scheduled to start. He pointed out that the capital cost of constructing a hydraulic mine in the U. S. S. R. is reported to be 33 to 40 percent of the cost of a mine using conventional mining methods. Scollon concluded that this type of mining deserves further consideration by the United States and reported that the Bureau of Mines is planning some preliminary field investigations to develop experimental data in the integrated hydraulic mining and transportation of coal.

CONVENTIONAL MINING— Training and Maintenance

ON Wednesday morning the Conventional Mining session was held under the chairmanship of Oscar A. Glaeser, president, United States Fuel Co.

First speaker of the morning was J. L. McQuade, president, Tioga Coal Corp., who discussed "High Production in Thin Seams." McQuade told how small crews at the Tioga mine are achieving high production in 38- to 42-in. coal using rubber-tired top-cutting machines, a new mine projection and bridge conveyors. He concluded that the company's new approach to thin seam mining has increased its tons per man output over what it was able to do by hand loading onto conveyors, provided better control of top and safer working conditions, and permitted the concentration of mining, with better and less supervision.

John E. Kaite, industrial engineer, Berwind-White Coal Mining Co., was the next speaker. His topic was "Foreman Training." The training program set up by his company was

designed to sell industrial engineering to a greater degree, train section foremen to be able to help prepare standard methods and work procedures based on time studies made by industrial engineers, foster foremen cognizance of their responsibility for equipment and preventive maintenance, and instill in them a desire for better communications, cooperation and motivation. Kaite described the program in some detail and told how the full cooperation of the section foremen was solicited and obtained. The company's eventual goal in industrial engineering is to have all sections on standards with a plan for all phases of production, supply and maintenance.

John L. Henley, master mechanic and chief electrician, Elk River Coal & Lumber Co., spoke on preventive maintenance as it is practiced at his company. He covered maintenance of substations, rebuilding and maintenance of haulage equipment, stationary motors and face equipment, and training maintenance men. In dealing with each of these subjects, he told about some helpful changes that the company has made on various

pieces of equipment. Henley summed up his paper with a few simple rules that are effective in preventing breakdowns, and emphasized the importance of having the machines operated only by skilled operators and maintained only by thoroughly trained mechanics and electricians.

The Conventional Mining Session was concluded by a paper on "Philosophy of Maintenance." Ralph B. Dean, administrative assistant, Lora-do Coal Mining Co., said that before an effective maintenance program can be designed, a philosophy of maintenance has to be decided upon. Dean dealt with the importance of such an approach, outlining many of the concepts that have special impact on the final maintenance program. He emphasized that a sound maintenance program is of paramount importance when considering continuous mining machines. Continuous mining is inherently a balanced work process, and optimum production can be obtained only by keeping these machines operational at all times. A sound maintenance program provides the sole means of approaching full availability for the equipment.

(Continued from page 61)

LAND AND WATER USE

A joint meeting of the Land and Water Use Committees of the American Mining Congress and National Coal Association was held on Wednesday. Here a full agenda was disposed of as members of both organizations discussed the problems of land use, water and air pollution, zoning and related questions in connection with all branches of the mining industry.

LADIES' EVENTS

Mining ladies were kept busy during the daytime with a special program all their own. A tea and reception was held Monday afternoon

and offered an opportunity to meet new friends and renew old acquaintances.

The Maketewah Country Club was the setting for a luncheon on Tuesday which was followed by an informative talk, "Is Your Voice You?," by Miss Phyllis Swisher of the Cincinnati Bell Telephone Co.

Wednesday noon a "Pink Party" was held in the ballroom of the Sheraton-Gibson Hotel. Here the program featured Leon E. Mattler, noted handwriting expert, who demonstrated the art of scientific handwriting analysis.

ENTERTAINMENT

Despite the full agenda of business matters the lighter side of the Convention was not neglected. In addition



Several special parties were held for the ladies

tion to the many scheduled and impromptu gatherings that play so important a part in making any convention a success, the week was highlighted by two big evening events.

Monday evening saw mining men and their ladies gather for the traditional Coal Miners Party at Castle Farm. Fine food, excellent dancing and an outstanding program of entertainment marked the occasion.

The Annual Banquet on Wednesday night served as a fitting climax to a busy convention week. James Gray briefly introduced industry leaders who were seated at the head table. There followed a sparkling entertainment program featuring Joe Sodja, Virginia Sellers and the Winged Victory Chorus.

A LOOK AT COAL

(Continued from page 57)

Capital industry as a whole needs better treatment in amortization charges. In the steel industry the \$10,000,000 plant of 20 years ago, that could be amortized reasonably under present regulations, is now a \$60,000,000-cost plant that can't be amortized in the same way. So the steel industry, the railroad industry and the coal industry need specialized treatment on those things, if they are to continue to be assets for the people of America, and if they are to be relied upon in the future when an emergency again comes.

The Russians are far exceeding the United States in their research and experimentation despite the magnificent efforts that our industry is making in that direction itself—on our own power and our own resources.

I am especially gratified at the program now in existence—of which my distinguished friend, L. C. Campbell, is a sponsor and promoter—to centralize research of the industry in a great laboratory to be located near Pittsburgh. It is badly needed. It is logical and proper and should have the support of the entire industry.

Some of our representatives in specialized fields in the industry recently returned from Russia to report that, of all of the research being conducted in all the combined countries of Europe and Asia, Russia is doing far, far the most—more people employed. They have come to understand the value of scientific research! They have the resources and the materials! They have manpower! They have no cost of production that can be compared with our own! And they are making the most of it!

So it is a problem that calls for thoughtful action and determination by all Americans. The Russian communists must not be permitted to impair or strike down the American economy or imperil the liberties of its free citizens.

NEXT YEAR

Another American Mining Congress Coal Convention has been entered into the pages of history. As those who attended returned to the mines to put into effect the new ideas learned during the meeting, plans are already being made for the giant Coal Show to be held in the Cleveland Public Auditorium, May 10-13, 1959. All indications point to a record Exposition, and work will soon start on the assembling of another fine technical program. Coal mining has never stood still, and at the rate new ideas and equipment are being introduced to the industry, the 1959 Coal Show will be a "must" for those who produce the fuel that powers the nation's progress.

COMPLIMENTS MINING CONGRESS

I want to compliment the American Mining Congress for the advanced position it takes on the problems of the industry, and its studious and scholarly approach to many of the industry's highly technical questions. That work should go on and I think increased efforts should be made to enlist public support for these programs.

I have thought at times that there is need in the industry for a central organization—non-technical—to deal with our national problems, the public interest and the over-all questions incident to continued existence that are not in themselves specialized or technical.

If I sat in the councils of the executives in the industry, I would urge that a committee be created to study that question and bring in a report and recommendations to the industry. I think the industry needs a forum—which to some degree exists in other industries—where all segments of our industry could come to discuss, to debate and to conclude on matters of major public policy and the acute problems that affect the industry.

The United Mine Workers of America will be glad to support and cooperate with such an agency. This industry now needs a common voice, recognized as such, to bring its problems to the attention of the government itself, the Congress, if needs must, and the American people, in addition. It needs the best talent and the best organization. Our industry and its leadership is capable of furnishing both.

Who speaks for the coal industry now? All of our great leaders are only able to speak for segments of the industry. And the influence of their words and the impact of those words upon their auditors are minimized by the fact they are speaking for a group in the industry.

We should have an agency the leaders of which could speak—a national agency, meeting at appropriate times, quarterly perhaps, voicing the re-

quirements of all of the industry and of all of those attached to the industry. This agency would be the voice not only of the investors of the industry and the management of the industry but also the manpower of the industry.

That voice, I assure you, would be much stronger and much more effective on the things upon which we could agree than the voices we have heard raised heretofore.

We have pending in the Congress at the present time bills that call for striking out the immunity from the Federal Coal Mine Safety Act of those mines now excluded from the Act's provisions—mines employing less than 14 men. In the year 1957 those mines produced seven percent of the total production of bituminous coal. They also produced 26 percent of all the accidents and fatalities occurring in the industry in the United States.

That's manslaughter! Why? Because, without peril to themselves they can kill a man or wholly incapacitate him, without the expenditure of any money; whereas, if they had to buy a fan or rock dust or bring in timber or quit using black powder, it would cost them money.

So what Congress has done, therefore, is to give them immunity from the law, which legalizes their right to commit manslaughter.

If this bill doesn't pass, I do think the least Congress could do would be to change that arrangement and forbid those small mines in the future from committing manslaughter but agree they can commit a certain amount of grand larceny each year on any citizen they can waylay.

It's better to rob a citizen than to kill him. Harsh words, but harsh results and harsh conditions.

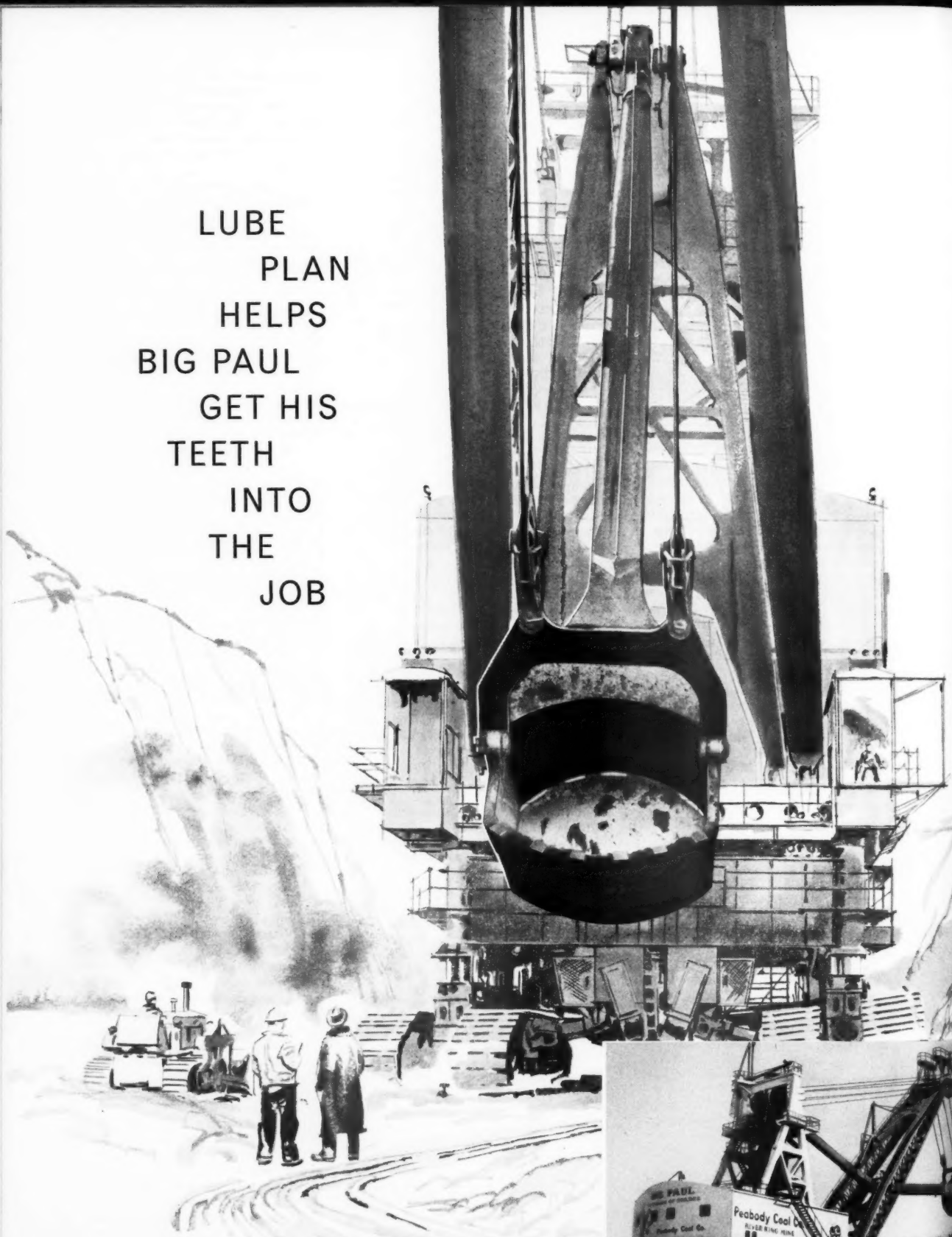
I hope that some of the more enlightened interests in the industry who have done so much to promote safety in their own mines and whose capital has daily been penalized by the operation of these small holes of the character about which I have been talking—I hope they will let the Congress know how they feel on the subject because every normal man feels the same way on that subject.

I think even Congress does, if we could get Congress to stop long enough to consider the moral factors involved.

My friends, the hour grows late. The officers of the Congress have a program to keep. I have already intruded upon it beyond my expectations. I appreciate deeply the interest you have displayed by your intent listening. I again express my thanks for the opportunity to be with you. I wish all success to this Congress and to the highly informative discussions that will ensue in your several group meetings.

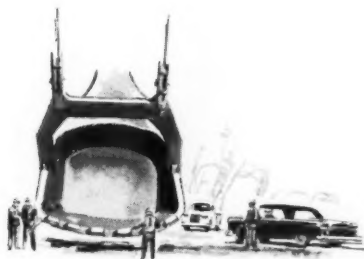
Thank you very much and I extend my best wishes to you with all good hopes for the future.

LUBE
PLAN
HELPS
BIG PAUL
GET HIS
TEETH
INTO
THE
JOB



Big Paul, located near Freeburg, Illinois, was started up on Standard Oil lubricants. Shovel can take a 70-cubic-yard bite off the top of a 12-story building, move it a city block and deposit it atop a 10-story building.





Before Big Paul had taken his first 105-ton bite out of the overburden at Peabody Coal Company's River King mine, Standard Oil lubrication specialist Hervie Dillingham was there to help. A survey of the lubrication needs of this mightiest of all shovels was made and a program laid out for lubrication maintenance. The result is that Big Paul performs as expected every day, good weather or bad, hot or cold, wet or dry.

There are three reasons why, as far as lubrication is concerned, Big Paul is able to deliver this kind of performance:

1. The lube survey. This was a thorough run-down and analysis of equipment to be lubricated and the kind of lubricants that would do the job best. It had to be done by someone with experience in this kind of work.

2. The lubricating oils and greases. Protecting this important piece of equipment with the best possible lubricants is just good business. Peabody management men relied on Standard Oil products.

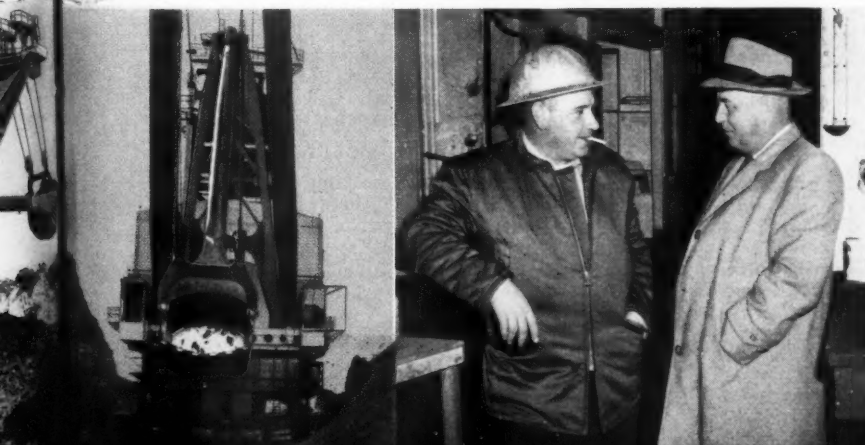
3. Experienced technical service. Standard's Hervie Dillingham has 20 years' experience providing lubrication technical service to mine operators. He knows mine equipment, the kind of conditions under which it operates, the best methods for maintaining it and the lubricants that will most economically and efficiently do the job.

You can get this kind of service on the lubrication of *your* mine equipment. Call the Standard Oil lubrication specialist nearest you anywhere in the 15 Midwest or Rocky Mountain states. Or write **Standard Oil Company, 910 South Michigan Ave., Chicago 80, Illinois**

YOU EXPECT MORE FROM



AND GET IT!



Standard's Hervie Dillingham calls on River King superintendent, Bob Harmon. Mine lubrication is a specialty of Hervie's. He has 20 years' experience in such work.

Advances in the Art of Dense Media Cleaning

By **EMERY O. MILLIGAN**
Preparation Manager
Freeman Coal Mining Corp.

Dense media cleaning has been brought within the reach of all coal operators—large or small

THE cleaning of coal with dense media is not new. The first dense media process for the separation of minerals from their impurities by float-sink methods was used in 1858, but the use of fine ground magnetite was not employed until 1922. Since that time it has been used as a practical medium for separating coal from its impurities, and installations have increasingly earned popularity in the field of coal preparation.



Most companies in this country today, which have regularly supplied jigs or launders, are also offering dense media in answer to the demands of the coal industry for more efficient means of

cleaning coal. Many modern plants now in operation have demonstrated the fact that dense media adequately meets their demands.

Several versions of dense media are used in the coal industry. Each version is comprised of two parts: The bath circuit, which includes the separatory vessel in which the float-sink separation takes place, and the medium recovery circuit. Basically, all dense media separatory vessels can be classified into one or more of five categories: Those which do not and those which do use rising currents from the bottom zone of the bath for the purpose of retaining material in hydraulic suspension; those which admit the feed material at or near the surface of the bath, and those which forcefully submerge the feed to the lower zone of the bath;

and finally, a classification which differentiates between vessel types utilizing skimmer conveyors for removing float at the bath surface, and those which discharge float solids over a hydraulic wrier.

Vessels which do not use rising currents must use a very fine grind of magnetite (90-95 percent through 325 mesh) so that the magnetite will not settle out too rapidly.

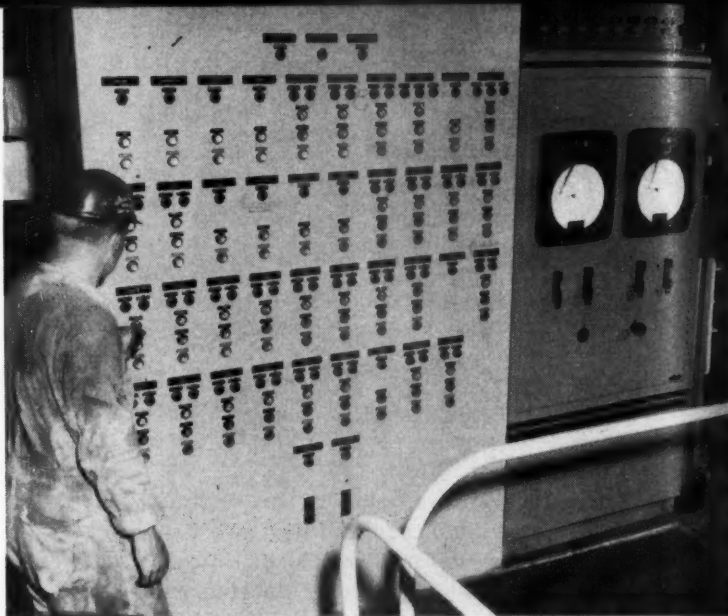
Maintenance of the specific gravity at a predetermined level is of the utmost importance in producing uniform results in any dense media washing system and this can be accomplished better with magnetite than with other minerals.

The recovery of magnetite is an important factor. There are many types of magnetic separators which recover the magnetite for reuse. One factor to remember is that where an electro type separator is used a record of the voltage should be kept. A reduction in voltage will greatly increase the loss of magnetite. Permanent types are being used widely with very little maintenance and they have proved very satisfactory in most cases.

There are many plants maintaining good control and maintenance that report only ¼-lb loss per ton of feed, but approximately ¾-lb is average.

Practical sizes to clean with dense media are 8-in. top size and ¼-in. bottom size. There are some plants cleaning down to ⅛-in. bottom size with very good results.

If a difficult separation is encountered, it is practical to break the



Coal preparation plant control panel and Foxboro control panel for dense medium vessel. Dense media cleaning has shown much progress in recent years

Recovery of magnetite is an important factor. Many plants, maintaining good control and maintenance, report only 1/4-lb loss per ton of feed, but approximately 3/4 lb is average



When a plant is equipped with automatic controls, the operator is free from testing and can give all of his attention to the mechanical operation of the plant. The above view shows the dense medium automatic control valves on bottom of thickener

sizes down to 8 by 1 1/2 in. and 1 1/2 by 1/4 in. or 1/2 in. and wash in separate units, depending on the quality of coal to be cleaned and the desired gravity of separation.

Dense Media Plants for Metallurgical Coal

There are plants that are preparing coal with dense media for metallurgical purposes that would not be able to accomplish it in conventional washing plants. Some of these plants are producing two grades of coal: Either by washing the product in conventional washers and re-treating it in dense media plants or by washing the product in dense media and re-treating the reject in conventional washers. The best method can only be found by knowing the particular coal to be cleaned and the needs of the sales organization.

A dense media plant can be operated cheaper in most cases than can a conventional washer. This is due to better control and greater realization for the clean coal.

There are several types of dense media units on the market and all are having some degree of success. Also, there are several unit washers on the market for the small operator, and in most cases they are cheaper to install than a conventional washer per ton.

One should take into consideration the desired cleaning efficiency and the capital expenditure in selecting a dense media plant.

The magnetite used in dense media plants will vary widely on the type of unit used. Coarse magnetite is much easier to recover than the fine grind; however, coarse magnetite can only be used in plants when a continuous circulating system is used.

Since the settling rate is too great on the coarse grade, "B" grade must be used on still bath units.

It has been found through data on different grinds that the settling rate is an important factor in uniform cleaning.

Test on Magnetite Settling Rate Test on Grade "B" Magnetite	
Specific Gravity	136
136 to 130	4 min.
130 to 120	7 min.
120 to 0	10 min.

Total Time 21 min.

Test on Grade "A" Magnetite	
Specific Gravity	136
136 to 130	1 min.
130 to 120	1 min.
120 to 0	2 min.

Total Time 4 min.

Cleaning 1/4 in. by 28M With Dense Media Cyclone

One process that promises a great future in the American coal industry is the comparatively new application of cyclones to dense medium cleaning

of fine coal. A true gravity separation takes place within the cyclone itself with this system. Material ranging in size from 3/4-in. diameter down to 35 mesh can be effectively cleaned at the feed rate of 50 tph per 20-in. diameter cyclone.

This process was developed in Holland and there are now several successfully operating plants in Western Europe and the British Isles.

Briefly, the above system consists of delivering a pre-sized feed to a small pulping tank where it is blended with magnetite in stable suspension. The resulting blend is then fed to the cyclone under a constant head. This is usually accomplished by mounting the pulping tank a specified distance above the cyclone. Separating forces within the cyclone discharge the lighter washed particles through the overflow together with the greater portion of magnetite. The heavier gravity material is discharged through the apex as underflow. Standard rinsing screens are used on both

REPORTED OPERATING EFFICIENCY OF DENSE MEDIA PLANTS

Mine	Size Feed (In.)	D. M. Unit Assemblies	Feed Capacity	Sp. Gr. of Sep.	Magnetite Consumption	Misplaced Prod. of Separation	% Oper. Efficiency
A	5 x 1/4	8	1300 P	1.55	1.0 lb	1.06%	98.94
	5 x 1/4	6	910 S	1.40	1.0 lb	1.06%	98.94
B	5 x 1/4	1	250	1.40	0.4 lb	0.65%	99.35
C	5 x 1/4	2	450	1.45	0.6 lb	0.90%	99.10
D	5 x 1/4	1	100	1.45	0.3 lb	0.80%	99.20
E	5 x 1/4	1	100	1.40	0.5 lb	0.70%	99.30
F	8 x 3/16	3	625	1.50	0.7 lb	0.85%	99.15
G	6 x 3	1	305	1.33	0.4 lb	1.24%	98.76
	3 x 1 1/4	1	276	1.37	0.6 lb	0.90%	99.10
	1 1/4 x 1/4	2	383	1.40	1.3 lb	0.95%	99.05
H	6 x 1/2	1	275	1.50	1.7 lb	1.95%	98.05
I	7 x 1	1	248	1.35	0.4 lb	1.24%	98.76
	1 x 1/4	1	140	1.40	0.4 lb	0.95%	99.05



In this type of dense media separatory vessel, a skimmer conveyor is used to remove float at the bath surface

the rejects and the clean coal with the recovered "dense medium" being returned from the first section of the screen and back to the pulping tank.

The dilute medium, resulting from magnetite being rinsed from the two products by sprays, is pumped to a drum-type magnetic separator. The recovered magnetite is returned to the pulping process. Tailings-bearing water is either discharged directly from the system or used in pre-wetting raw coal on the desliming screen ahead of the cyclone.

A unique and important feature of this system is the fact that the separating density of the rotating mass within the cyclone is considerably higher than the specific gravity of the feed, thereby resulting in a comparatively small regenerating system in relation to the tons-per-hour feed to the cyclone.

Other factors bearing upon further interest in this process are:

1. The system requires much smaller plant space than present conventional fine coal cleaning processes.
2. It can easily be arranged in multiple units separating at different gravities.
3. Its sharpness of separation is not affected by variations in load and raw coal composition, providing the initial tph is not exceeded.
4. Degradation is surprisingly low. Actually, degradation that does take place within the cyclone occurs more to the reject material than the recovered coal. This is explained by the fact that the heavier material remains in contact with the cyclone wall much longer than the lighter clean coal which moves almost immediately toward the center section and out the overflow orifice.
5. The separating gravity of the cyclone washery can be predetermined to cover practically any range in bituminous coal cleaning. This, in itself, makes it one of the most versatile fine coal cleaning processes in existence.

Automatic Specific Gravity Control Circuit With the Use of Diptubes

This system is completely automatic and recording. Originating around 1940 and improved through the years, it has proven to be very

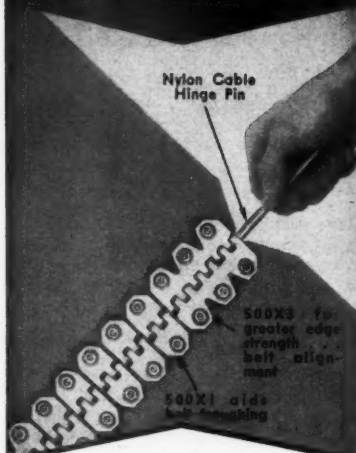
satisfactory. The principle of the system is the fact that when a diptube is submerged in water, a certain pressure is required to make the air escape. The pressure increases with an increase in the depth of submergence and it decreases as the depth of submergence is decreased. When applied to a liquid with a density higher than the density of water, it is found that, with the same depth of submergence, the pressure required to make air bubbles escape is in proportion to the density of the liquid. Therefore, one tube could be used with a constant level in actual operation. Fluctuations in the level, however, can never be avoided. Therefore, two diptubes of different lengths are used and it is found that the difference in air pressure in the two tubes is in proportion to the specific gravity. Difference in pressure is relayed to a recorder which registers this signal on a chart which is graduated into specific gravity units. The recorder has a master needle which is set for the required specific gravity. A certain pressure goes with this gravity. When the signal received by the recorder is equal to or less than the air pressure controlled and set by the master needle, nothing happens. However, as soon as the received signal is greater in pressure than the air pressure from the master needle, the pilot valve is activated. This pilot valve admits compressed air to a diaphragm-operated needle valve. This needle valve is located under the thickener and admits medium with a high density to the dense media vessel. As long as the received signal is in excess of a certain pre-set valve reading, the needle valve stays open and admits more medium to the vessel. When the specific gravity reaches the desired point and the signal is equal to the pre-set valve, the pilot valve closes and it in turn closes the needle valve. When equipped with automatic control, the operator is free from testing and can give all of his attention to the mechanical operation of the plant.

WHERE SPEED COUNTS...

use

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**HINGED 500X
BELT FASTENERS**



UNDERGROUND COAL MINING

THE IDEAL FASTENER FOR JOINING EXTENSION BELTS. DESIGN PERMITS THE USE OF A SMALLER FLEXIBLE NYLON CABLE HINGE PIN FOR SMOOTHER, TIGHTER JOINTS.

NYLON CABLE HINGE PIN . . .

- ✓ Easy to insert or pull out . . . will not migrate.
- ✓ Smooth wearing surface—nylon is self-lubricating.
- ✓ Will not unravel when cut.

Start now to equip your extension belts with FLEXCO 500X "SEPARABLE" FASTENERS (new FLEXCO HINGED 500X FASTENERS are interchangeable with old HF 500 Fasteners).

HANDY PACKAGE



Carton contains one complete belt joint—fasteners, pin, bolts and nuts.

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INCENTIVE AWARDS for GOOD SAFETY RECORDS



Based on six principles, a large asbestos producer's safety program has achieved the desired results

By JOHN McKENNA SMITH

Safety Engineer
Asbestos Corporation Ltd.

AWARDS for safety achievements have been extensively used by Asbestos Corporation Ltd. in Thetford Mines, Quebec, during the past six years. It has been found that when this period is compared to an equivalent period prior to the introduction of an award program, the accident experience has improved appreciably. To attribute the improved experience solely to safety incentives would be incorrect, for supervisory training and revised and improved methods have certainly helped our accident prevention program; nevertheless, no single feature has been more instrumental in making our workers safety

conscious than the application of safety incentives.

The company is engaged in mining and milling asbestos ores in the Thetford Mines-Black Lake district of Quebec. Some two thousand men are employed and three plants are currently operated with a large expansion program in progress at one of them. Each plant consists of a mine, a mill, maintenance shops and facilities for the storage and shipping of bagged asbestos.

Mining is carried out by open pit and block caving methods. During

1956, the average daily tonnage of material mined was 42,478 tons; when stripping in the open pit areas is included the average daily tonnage was 45,300 tons. Seven percent of this was mined by the block caving method. The milling of asbestos ore is a dry process in which the rock is crushed and dried, and the asbestos fibres are then separated from the rock and graded by screening and aspirating. The finished product is bagged in jute or paper bags. No manufacturing is done by the company; the crude or milled asbestos is sold to manufacturers throughout the world.



Objectives based on an accident frequency rate far below the industry's average would be extremely difficult to attain, and employees might lose interest in the program. Pictured is a section of the British Canadian pit

Incentive Plan Began in 1951

Some seven years ago, during the spring and summer of 1951, the Safety Department of Asbestos Corporation Limited began to examine several plans which would help to improve the safety record of the company. It was felt that if accident prevention could be constantly before the worker, the accident frequency and severity would decrease, thereby lowering the compensation rate, since this company operates on a merit rating basis within the rate structure set by the Quebec Workmen's Compensation Commission for the Quebec Asbestos Mining Association.

A safety incentive plan was proposed to management as a means of improving the accident experience. It was felt that to be successful this plan should be based on six certain principals.

Management accepted a safety incentive plan based on these principles. This plan was put into effect on November 1, 1951, and is still in operation.

Six Principles Are Basis

Before describing the results which have been achieved by this plan, it would be appropriate to elaborate on each of the principles and show how they were applied by the company.

The success of the plan is due in no small way to strict adherence to the basic principles.

Principle No. 1. The objective to be reached in order to qualify for

safety awards should be realistic and possible to attain by any group which pays particular attention to accident prevention. Before proposing any safety incentive plan, it is advisable to review the past experience of the company and the experience of other organizations engaged in the same type of industry. This review or survey will serve as a guide in setting objectives to be reached to obtain safety awards.

It would indeed be unrealistic to base objectives on say a yearly frequency of five lost-time accidents per million man hours of exposure when your best previous frequency has been twenty and that of the industry twelve. In other words, examine your records and set your objectives so that they may be reached by extra effort in the field of accident prevention. Do not expect miracles and do not set the objectives so high that the employees will feel that they cannot attain these objectives.

At Asbestos Corporation Ltd., a survey of past experience and local conditions indicated that consecutive man-shifts worked without a lost-time accident would be the best basis on which to make awards. This basis had several advantages, among which were:

(a) Within the reporting or labor accounting set-up, this figure could be easily reported by the timekeeping departments daily.

(b) If a lost-time accident occurs on any day during the month or other periodic breakdown, it is not necessary to wait until a new period begins before

another no-accident record can start to be accumulated.

The objectives were set in such a way that once the first one was reached, the group continued to amass consecutive shifts since the last lost-time accident. When the second or third objectives are reached, awards of greater value are distributed. To be more specific, groups or plant divisions are awarded safety incentives after they have worked 10,000, 25,000 and 50,000 shifts without a lost-time accident. The value of the award at 25,000 shifts is approximately two and one-half times the value at 10,000 although only 15,000 consecutive shifts have been added to the total.

Principle No. 2. The employees should know where they stand in relation to the objective during the time that the plan is in operation. This principle is extremely important in any work where an objective is being attained. Everyone is familiar with the thermometer type of chart which is used in charitable campaigns and war bond drives. In the case of the safety incentive plan, bulletin boards were established at the plant entrances or in the punch clock rooms, showing the number of consecutive man-shifts worked since the last lost-time accident for each group operating as a unit under the plan. These boards are kept up-to-date daily by the timekeeping department at the plant.

Principle No. 3. The awards or incentives should be distributed to as many of the employees as possible. Several plans are in operation in which the supervisory employees are rewarded for safety records established by their workers. Other plans allow so many awards per department or per 100 employees. Awards are distributed to each employee of the department or plant division which is eligible under the plan.

By every employee receiving an award two employee oppositions to an incentive plan are eliminated:

(a) Workers wonder why establish the safety record when the supervisor receives the reward.

(b) Many employees feel that if their name were one of two names placed in a box and one name were to be drawn to receive a safety award, their name would certainly not be drawn. In other words, they are just not lucky when it comes to lotteries.

All production and maintenance employees, the plant supervisory and clerical staff, and watchmen are eligible for safety awards under the present incentive plan. Head office staff, laboratory employees and a group which work at our non-operating properties are not included in the plan.

Principle No. 4. One group of employees should not be penalized for the poor performance of another group. It is advisable when setting up a safety incentive plan which is based

on group incentives to have groups or units made up of employees doing the same type of work. The groups should not be too large, because too many employees might be penalized for the poor safety performance of a small proportion of the group. Since this is a group effort, it requires good teamwork and it is amazing to see the way some of the older employees will advise new men when they see the latter performing in an unsafe manner.

The breakdown of each of the plants of Asbestos Corporation Ltd. for the safety incentive plan followed the lines of the main working divisions: i.e., mine, mill, shops or maintenance, and general or yard labor. Each group is a unit which, for the purpose of this plan, operates independently. If a lost-time accident occurs in the mill, it does not affect the records established by the other groups. The groups are not all equal in size but, by setting the objectives on the basis of consecutive man-shifts worked since the last lost-time accident, the exposure to injury is equal for all groups.

It is interesting to point out here that the objectives have been set the same for all groups, this decision being based on the analysis of the company's experience for an extended period of time prior to the establishment of this incentive plan. There were several objections on the part of the employees to this; many maintained that their department or work was more hazardous than that of another department and should therefore receive a handicap. Experience since the establishment of the plan has shown that the equal objectives for all groups were justified. However, this is a point that should be carefully studied before any incentive plan is put into operation.

Principle No. 5. It is better to give tangible prizes than monetary awards. It was felt at the inception of this incentive plan that it would be preferable to distribute useful items as safety awards than to give the employee the equivalent in cash. Many companies distribute individual pins, or departmental trophies; this certainly advertises the accident prevention program but it is felt that a pocket knife, wallet or some small tool is a more constant reminder of accident prevention to the employee. The distribution of useful items has been quite popular among the company's employees.

Principle No. 6. The safety incentive plan must be understood by all employees. This is a basic principle which applies to any incentive plan which is initiated and operated by a business organization.

When the safety incentive plan was initiated, notices were posted on all company bulletin boards explaining its operation. Meetings were held

with supervisors to illustrate in more detail just how the plan would work. When new employees are hired, the plan is explained in the pre-employment interview.

To recapitulate briefly the safety incentive plan of Asbestos Corporation Limited: Each operating plant of the company is subdivided into four sections which operate independently in establishing safety records of consecutive man-shifts worked without a lost-time accident. When one of the following objectives is reached, 10,000, 25,000, or 50,000 and so on in 25,000-shift increments, each employee in the section attaining that objective is entitled to a safety award if he has worked at least 75 percent of the time in that section during the period in which the record or objective was being established. If a lost time accident occurs in a section, the cumulated man-shifts drop to zero and a fresh start is made.

Employees Have Choice of Awards

The selection of suitable awards is of sufficient importance to warrant a few paragraphs of discussion. When employees of a particular group become eligible for awards, they are as a rule entitled to their choice of one of five or six items. This might sound rather strange to some who are used to distributing the same item to all eligible employees.

There is no doubt that this system entails more work and possibly has some disadvantages, but it is more acceptable to the employees. If it was decided that everyone was to receive a flashlight or a pen knife there would be many complaints about how many they already had; there-

fore, it is wise to allow a choice of awards.

The selection of the five or six items from which the employee will choose is made along the following principle: two personal items—i.e., pocket knife, flashlight, lighter; two items for the home—Pyrex ware, table lighters, mixing bowls; two tools—i.e., hand axe, pliers, tapes, etc.

To illustrate the range of awards which have been distributed to our employees over the past 5½ years, the following list for each series of awards has been compiled:

First Award (10,000 shifts)

Mixing bowls, flashlights, table lighters, playing cards, ash trays, pipes, thermos bottles, wescot wrenches, combination squares, hammers, tinners' snips, hand axes, wrench sets, ball point pens, razors, and several others.

Second Award (25,000 shifts)

Steak knives, Silux coffee makers, bill folds, vices, can-openers, casting rods, pipe wrenches, pocket watches, a cash allowance on a pair of safety shoes, First Aid kits, and several others.

Third Award (50,000 shifts)

This is reached on an average of once a year by one of the sections within the company. The awards consist of: safety footwear, flash camera, carving set, socket wrench set, aluminum chairs and in some cases, combinations of two 25,000 shift awards.

Fourth Award (75,000 shifts)

This mark has been reached once by one section. At the request of the majority of the employees in this section and with the approval of management, instead of increasing the value of the individual awards as done for the first three objectives, each employee received an award in the 25,000 shift range and a drawing was made for two television sets, installed in the employee's homes complete with outdoor antenna. Needless to say, this created considerable interest



Thetford Mines, Quebec, with the Beaver mine of Asbestos Corporation Ltd. in the foreground

in accident prevention throughout the company; the president and general manager, along with other top company officials, were present for the drawing. The event was covered by the local press and some local correspondents for the metropolitan dailies. The company will indeed be happy to see another group reach the 75,000 shift mark, but when this happens a drawing for an expensive award will be made only if it is the expressed wish of the majority of employees of the section.

Improvement In Accident Prevention Accelerated

Anyone who has worked in accident prevention will readily realize that it is difficult to attribute improvement in safety experience to any one item. As was mentioned at the beginning of this article, the company has been constantly changing and improving working methods, and has had an active supervisory training program in effect during the past five years. Therefore, it is necessary to indicate the improvement in the safety experience which has been made since the inception of the safety incentive plan and point out some features which might be directly attributable to accident prevention awards.

Table I is a breakdown of our accident experience from 1947 through 1956. This period was chosen be-

TABLE I
ANALYSIS OF ACCIDENT EXPERIENCE, COMPENSATION AND SAFETY INCENTIVE COSTS, 1947-1956

Year	Lost Time Acc.	No Lost Time Accidents	Days Lost	Hours of Exposure	Frequency	Severity	Compensation Cost	Incentive Cost
1947	232	198	5,824	4,461,293	52.0	1,305	\$121,017	
1948	158	266	10,127	4,629,157	34.1	2,190	32,616	
1949	102	153	15,231	3,141,106	32.5	4,850	60,061	
1950	132	209	15,036	4,482,137	29.5	3,350	102,688	
1951	91	216	1,602	4,361,779	20.8	367	22,914	
1952	54	199	8,492	4,143,237	13.1	2,055	22,178	\$9,355
1953	63	203	7,742	4,062,835	15.5	1,905	38,319	6,613
1954	29	232	7,781	4,177,222	6.9	1,860	25,886	9,795
1955	52	267	1,542	4,387,010	11.9	353	31,262	7,575
1956	38	252	1,168	4,299,542	8.8	272	29,173	7,394

TABLE II
COMPARISON OF ACCIDENT EXPERIENCE, COMPENSATION AND SAFETY INCENTIVE COSTS, 1947-1951—1952-1956

Period	Lost Time Acc.	No Lost Time Accidents	Days Lost	Hours of Exposure	Frequency	Severity	Compensation Cost	Incentive Cost
1947-51	715	1,044	47,820	21,075,472	33.9	2,270	\$339,296	
1952-56	236	1,153	26,725	21,069,846	11.2	1,268	146,818	\$40,732

cause it illustrates a period of five years, 1947 through 1951, prior to the introduction of the safety incentive plan and a five year period, 1952-56, that the plan has been in operation.

Table II is a compilation and average of these two five year periods.

These records certainly indicate an improvement since the inception of the safety incentive plan. When the

compensation cost plus the incentive cost for the 1952-56 period is compared to the compensation cost alone for the 1947-51 period, a yearly average saving of over \$30,000 is found, and this in a period when compensation benefits as well as wages were increasing.

It might be noted that a downward trend had started in the accident frequency, severity and costs when the incentive plan was introduced. However, it is quite definite that the introduction of safety awards accelerated the improvement in accident prevention.

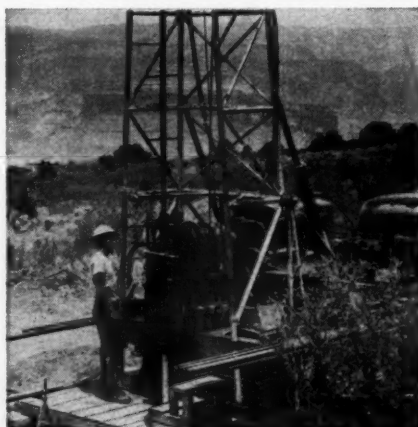
One feature which really stood out after the initiation of safety incentives was the sharp reduction in lost-time accidents involving one to three days lost time. When the employees realized that this was a "team" or group contest, everyone co-operated in not losing time for minor injuries, a practice which had been prevalent in previous years. The company encouraged the employees to return to work by allowing them to relocate to a less arduous task for a short period of time, provided the work which they would be doing was of such a nature that it would have to be done during the course of operations.

The application of safety incentives at Asbestos Corporation Ltd. in Thetford Mines has been successful in achieving the results which were desired when the plan was formulated and introduced, i.e., an improvement in our safety record and a decrease in compensation costs.

It is believed that safety incentives when properly applied will produce the following results:

- Workers will become more safety conscious.
- Compensation costs will decrease.
- Accident frequency and severity will improve.
- Workers will accept the safety program more readily when they realize that management is willing to compensate them for safety achievements.

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Preliminary reports indicate that bit choice depends, to a large extent, on particular problems encountered in individual operations. The AMC Underground Drilling Committee has initiated a much more comprehensive survey, the results of which will be published when completed

Evaluation of Carbide Insert Bits



By JAMES W. CLEMENS

General Operating Engineer
The M. A. Hanna Co.

SINCE the introduction of the detachable tungsten carbide insert bit, the mining industry has been faced with a problem which has never been solved to the satisfaction of everyone. The problem is that of obtaining a bit life that will allow 100 percent use of the insert before the bit fails in some other manner.

The common causes of failure that have been noted are:

1. Thread strippage
2. Bit breakage (skirt or wings)
3. Loss of bit because of rod failure

There is also bit loss because of theft or careless handling which will occur no matter what type bit is used.

The American Mining Congress' underground drilling committee has enlisted the cooperation of many companies in order to help solve this problem.

Many Still Using Threaded Bits

Despite many reports of thread failure, some operators are still using

the threaded insert bit. The comments of a few of these companies are listed in Table 1. Summarizing these comments, nothing startling is uncovered except: two of the companies report an excessive amount of carbide left after bit failure.

Certainly there are many other companies that have had the same results. At the M. A. Hanna Company's five underground mines in the Iron River district no verifying records are available, but it can safely be said that loss owing to thread failure will exceed 50 per cent of the tungsten carbide in the bit. One question which has never been answered satisfactorily is why threads will strip in one instance and hold satisfactorily in another case where drilling conditions are mechanically the same. The general conclusion is that the uniformity of hardness of the ground has something to do with it, but no testing has been done to substantiate the belief. Also, it is well known that miner prac-

tice; i.e., proper sharpening interval, keeping the bit bottomed, etc., has much to do with threaded bit life.

Yes, it is agreed that there are many ways to increase thread life of insert bits; however, some underground operators will not afford the close control necessary to do so, and therefore choose to substitute a bit with a connection which will hold up without too much close attention.

Taper Bit Gaining Popularity

The taper socket, or push-on type bit seems to be receiving some attention and a brief outline of the reports from companies using or doing considerable testing on tapers appears in Table 2.

Hanna conducted one fairly conclusive test in which drilling was done with both the threaded and six-degree taper bits. A row of four holes was first drilled with one type of bit, and then a row of four with the other. Drilling was done in this manner to obtain a good comparison of the two connections. The threaded bits averaged 298 ft. per bit, and all failed by thread strippage with only about 30 percent of the tungsten carbide being used.

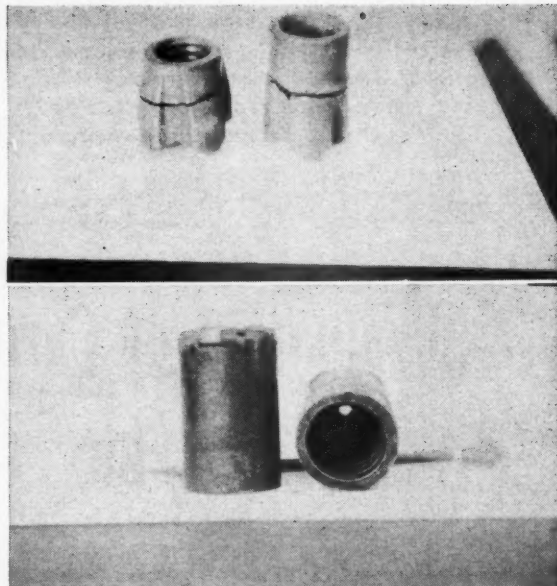
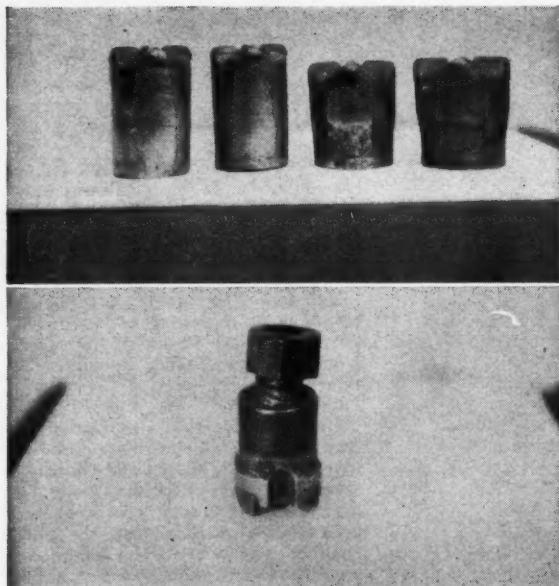
The taper bits averaged 853 ft. per bit and all were completely worn out when taken out of service, except one bit which was still usable when the test was completed.

Excessive thread wear in the past has been noticed by observing results of production drilling where threaded bit life appeared to be about 200 ft. The aforementioned test substantiated this figure and indicated much better footages could be obtained with the taper bit.

Prior to this test, the "H" thread size for drill rods had always been maintained under 0.997 to facilitate the use of hot-mill reground steel bits. Since the test, the thread size of the rods has been increased to 0.999+ and preliminary reports indicate less thread strippage with the insert bits is being realized.

Also, as a result of this test, a number of taper bits were put into service in some development headings. Soon after, ring-off trouble commenced which reduced footage per taper bit to a figure about the same as for threaded bits. This standard of performance, coupled with the fact that no method has yet been developed to adapt the taper to extension-rod drilling in stopes, would eliminate tapers from consideration altogether. However, it was felt there must be a solution to the ring-off problem and work continued on the tapered connection.

For lack of time and facilities for doing all of our own test work Hanna investigated what some of the other companies had done. Bit suppliers also were called upon to attempt to solve the problems occurring with the



UPPER LEFT—one test indicated a higher percentage of usable carbide in the taper bit. The two threaded bits at the right were used alternately with the two tapers at the left. Note the amount of insert remaining in each of the stripped threaded bits, whereas the taper-bit inserts are almost completely used—UPPER RIGHT—ring-offs have been experienced with both the taper and threaded bits—LOWER LEFT—broken buttons have been removed from bit by brazing nut to exposed end—LOWER RIGHT—carburized steel with 400 series thread has proven satisfactory in jumbo drift work. The bit shown drilled more than 10,000 ft with the same rod in a medium slate and iron formation

taper bit. Most of their work was done under operating conditions, for as previously mentioned, all the trouble was occurring in actual operations.

The conclusions reached by the bit suppliers were much as expected, and their proposed solutions were evident. The most prevalent, of course, was the need for a proper sharpening interval. A slight increase in skirt thickness also was incorporated in one of their tests and it is not known which factor, the proper sharpening or the thicker skirt, was responsible for the increased bit life which exceeded 600 ft. per bit with all the bits still drilling. No ring-offs occurred in this test.

Face-Grinding Will Maintain Gauge

Mentioned previously was the fact that proper resharpener interval is important, but the proper sharpening technique also must be observed. A bit grinder can get what appears to be a good sharpening on a bit, but in doing so, he may take an excessive amount off the gauge of the bit. For this reason bit grinders have been instructed to face-grind the inserts to eliminate a portion of the rounded edges of cutting wings.

Wet grinders are utilized at Iron River mines which use insert bits in quantity.

Unusual ground conditions have been found in some of the harder ores. First glance at a bit which has drilled only a few feet in this ground indicates practically no wear. Upon close observation of the bit, it can be

seen that the cutting edges and the corners are very polished.

Miners more familiar with ground which is abrasive, but not particularly hard to penetrate, will not keep their bits sufficiently sharp for this "tough" ore and the slightest gauge or cutting edge wear greatly reduces penetration and increases stresses on bit, rod and connection.

Companies Testing Tapers Versus Threads

The underground drilling committee of the American Mining Congress has received some excellent information from companies that have run extensive tests on taper bit versus threaded bit. Some of this information is contained in Table 3.

It is interesting to note the reasons given by Company No. 3 for not using threaded bits:

1. With the great number of stopers in operation, the machine shop, blacksmithing, and heat treating problem would be intolerable.
2. Threaded steel would imply carbide insert bits of the regrindable type and the expense for bits lost due to steel breakage in the hole would be excessive.
3. From past experience theft of threaded type insert bits is excessive and difficult to control.
4. The regrinding problem for the large number of bits in the circuit would be insurmountable.
5. All stopers used are tappet machines and experience indicates the regrindable carbide bits do not hold up well in some types of ground and in this type of machine.

Company No. 4 gave a percentage breakdown on failure of threaded bits. A glance at these threaded bit replace-

ment figures indicates that practically no bits were worn out in terms of carbide life. Further, that up to 50 percent of all bit replacement was necessary because of thread wear.

In addition they stated, and the same is true in Hanna's experience, that many of the "lost or not returned" bits had actually failed in the threads or been broken.

This company, which has probably done more testing than any other on the taper bit, summarizes:

1. It is convinced of the potential economy offered by the tapered bit and connection, and experience to date indicates a primary application with light drills and air legs.
2. Direct savings will be tangible and rod preparation costs reduced.
3. Quality control and a better understanding of the mechanics of the taper bit and taper connection stresses are needed.
4. The proper drill steel, metallurgically designed, is a must if the full potential of the taper bit is to be attained. In short—steel and bit are a "package deal." Testing of carburized steel indicates possibilities, and many advantages in spite of higher first costs.
5. The problem of miner acceptance makes necessary the development of a good, safe bit removal tool. Standardization of rod taper is essential. Presently there are at least three: the 6-, 8-, and 12-degree included angle taper. The 12-degree angle offers, by far, the easiest bit removal.
6. Stability of the taper connection, bit to steel, seems to offer no problem with any of the tapers tested to date.
7. When the taper connection does break while drilling, salvage of the taper bit is more difficult than with the threaded type—re-emphasizing the need for a drill steel connection

which will more than match taper bit life.

8. Precise preparation of the rod taper is of the greatest importance if any success is to be obtained with taper bits. Manufacturing tolerances of the bit, both mechanical and metallurgical, must be within the prescribed limits.

Bit Manufacturers Can Help

On first observations, the taper socket bit appears to be the solution to many operators problems, but as in the case of every new product there are "bugs" which must be eliminated.

The bit manufacturers are aware of this and have been extremely cooperative in studying the problem and suggesting ways in which taper bit life can be increased.

Some of these suggestions have been mentioned previously, but it might be well to list separately the results of the manufacturer's investigations.

1. Accuracy of taper and surface finish are important. Avoid having the taper bear most strongly on the small end of the rod. Length of taper should be closely controlled.
2. Use shims and be sure remains of old shims are removed from bit.

Table 1. Comments of Companies Using
THREADED BITS

Co. #1 uses only threaded carbide insert bits in hard ground . . . sharpenings per bit average about 10 . . . no report on how bits failed, but about 50 percent of carbide remained at failure

Co. #2 has used threaded bits exclusively . . . due to thread strippage started testing integral steel . . . in integral steel carbide is used 100 percent . . . considering tapering intraset steel to get additional footage

Co. #3 reports very good results with thread connection . . . no desire to experiment with taper bit

Co. #4 tested six taper inserts and six threaded inserts; found insert life equal . . . tapers difficult to knock off, and two tips broke off in bit . . . prefer threaded bit, but will continue tests on taper bit

Co. #5 uses threaded bits in hard rock . . . very little thread trouble . . . some integral steel has been tested . . . air pressure of 85 psi ideal for carbide insert drilling . . . have had success with five-hole insert bit . . . bit life increased by following certain manufacturer recommendations, such as maintaining cutting angle of 110 degrees and limiting holes per sharpening to reduce premature failure because of excessive dullness

Co. #6 has been using threaded insert bits for years . . . in spite of ring-offs and thread failure cannot afford to use any other type bit . . . however, preliminary tests indicate taper bits are definite improvement

3. Be sure the miners use bit detachors. The practice of peening the skirt to remove the bit causes premature failure.

4. Keep the bit turning freely in the hole. This can be done by finding the proper cutting angle (and maintaining it), proper grinding interval, and good gauge grinding.

No attempt has been made to summarize this report, as most of the operators who have submitted information have summarized for themselves. Furthermore, the inconsistency

of results make an overall summary impractical.

However, it is felt there is sufficient information to conclude that the taper socket bit definitely has a place in underground drilling and, within a short time, many operators will be converting to this type of connection.

The underground drilling committee of the American Mining Congress wishes to acknowledge and thank the operators and manufacturers who supplied information for this study.

Table 3. Comments of Companies Testing
TAPER VS. THREADED BITS

Co. #1 intends to switch to taper bits after unsuccessful use of threaded bits over past years . . . tests provided basis for comparison . . . six-degree taper had 10 percent skirt breakage and were difficult to remove . . . 12-degree had no skirt failures and were easily removed . . . taper rods much more easily fabricated than threaded rods . . . life of threaded connection averaged 178 ft, that of taper connection from 470 to 900 ft

Co. #2 tested 12-degree taper bits in extremely hard ground (drilling rate about eight in. per min) with little or no success . . . disadvantages: bit removal was difficult, ground conditions required sharpenings every eight ft and therefore shim cost was excessive, knock-off block wore out or failed after testing only 10 bits

Co. #3 uses tapered, throw-away type, carbide insert bit in all stoping operations . . . a standardized 3/8-in. hexagonal collared steel in all drifting and stope preparation work . . . both threaded and taper connections have been tried . . . threaded bits have not been used because of several disadvantages (see text)

Co. #4 has tested taper bits, in cooperation with various manufacturers, for over two years . . . penetration rates vary 12 to 18 ipm in amygdaloids, 18 to 24 ipm in free-drilling, but hard and abrasive, felsitic conglomerates . . . results are felt indicative of trials and failure that come with a new product, but some success has been achieved . . . 12-degree taper has given very good results and has replaced threaded bit in one mine . . . premature pin failure results from using certain types of steel with taper bit . . . throw-away carbide insert bits merit further testing . . . compared to threaded bits, taper bits have a lower direct first cost, but necessity of brass or aluminum shims tends to equalize cost over period of time—especially in abrasive ground which requires frequent bit sharpening . . . overall costs of taper bits can be competitive with the threaded bit, and rod fabrication cost afford additional savings

This company has used threaded insert bits in all its mines and has averaged about 850 ft per bit . . . primary reasons for failure of threaded bits were:

- | | |
|-------------------------|--------------|
| 1. Lost or not returned | 33.7 percent |
| 2. Thread wear | 29.0 |
| 3. Ring-offs | 17.7 |
| 4. Insert failures | 14.2 |
| 5. New contracts | 4.9 |
| 6. Worn-out inserts | 0.005 |

Table 4. Comments of Companies Using
INTEGRAL STEEL

Co. #1 became interested in taper bit as means of increasing life of integral rods . . . first attempts to put threads on these rods met with failure because of inadequate heat treating controls . . . all taper bits from one test in hard ground were lost or damaged due to steel breakage in bit . . . a long taper seemed to cause more breakage than a short taper . . . company concluded threaded connection still best for carbide insert bit—reports only two percent failure due to thread wear . . . in thousands of feet of drilling thread failure has been almost negligible . . . integral steel provides best cost, but advantage is small, and costs rise rapidly when this steel is abused or over-drilled

Co. #2 uses integral steel for half of its drilling . . . when inserts are worn out the rods are cut off and threaded . . . tapers have been applied to these rods, but breakage occurs flush with the end of bit (this trouble is unique and has not been reported frequently)

Table 2. Comments of Companies Using TAPER BITS

Co. #1 has had poor results from threaded bit, therefore have switched to taper bit . . . report 1620 ft per bit with an average of six sharpenings per bit

Co. #2 found that increased air pressure and gradual hardening of ground caused excessive steel breakage . . . switched to carburized steel and taper bits with excellent results . . . no bits lost from skirts failure . . . faster drilling speed, probably because of additional water holes to flush cuttings more effectively . . . no taper failures in 30,000 ft of drilling . . . no trouble getting 12-degree taper bit off rod . . . stress proper grinding and constant vigil against worn chucks . . . smallest burned spot on hard inserts will cause failure

Co. #3 started testing taper bits to increase life of used integral steel . . . 12-degree taper tried first and indicated excessive pin breakage . . . six-degree taper very satisfactory

DISCUSSION: DRILLING CONDITIONS

DETERMINE BIT DESIGN

By MAURICE W. HAWKESWORTH

General Sales Manager
Western Rock Bit Manufacturing Co.

THE testing of drill bits and drill rod connections is being carried out by nearly every mining company. Results are variable. It is difficult to establish a uniform method of evaluation of test results from one property to another. This is due to ground variation, bit design, and type of equipment used.

The first carbide bits were the chisel type, used in integral steel, and the threaded, multi-use type. The integral tungsten carbide steel was introduced in Sweden. The low cost of production in foreign countries enabled them to produce a cheaper bit than could be manufactured in the United States and Canada. The integral chisel type bit is still in use today; however, it has been replaced with the multi-use bit in the majority of properties.

The first detachable multi-use tungsten carbide bits were made with threaded connections. The advantages of this type bit over integral steel

were in nipping and in bit design. It was found that the cross type bit was more suitable in varying ground conditions, thus the majority of properties used this type of bit. The threaded bit has its limitations, as outlined previously in this article; namely, overdrilling; improper grinding in resharpener; premature thread wear, and ringing off.

Many manufacturers of drill bits are manufacturing both a threaded and a taper-socket, multi-use, tungsten carbide insert bit. It has just been within the last few years that we have seen the successful introduction of the taper bit. A bit of this type has an advantage in that it lowers the cost of steel fabrication. It not only offers a strong connection, but eliminates the upsetting, annealing, and threading of the drill steel. It has the same disadvantages as the threaded type in over-dulling, over-grinding, connection failure, and



Wet grinders are practically a necessity when many insert bits must be sharpened. Proper grinding technique is vitally important

pilferage, plus an additional shim cost. There are a variety of different tapers to choose from.

The single-pass taper socket carbide insert bit is being successfully introduced into the mining and construction fields. This bit is entirely new in design. It is a four-wing bit in which shallow carbide inserts are bonded. The inserts are so designed that even when dull a reverse taper does not occur, as is the case with multi-use bits. This design permits the bit to drill far beyond the dulling point of the multi-use bit. The bit is drilled to destruction without the need of re-sharpening. A brass shim used in the short-taper socket bit makes removal easy. The advantages of this type of bit are: low cost per bit, low cost of steel preparation, and the elimination of re-sharpening.

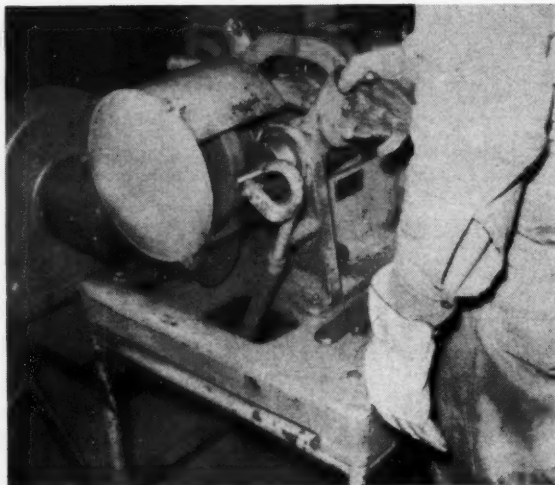
The preparation of taper connections on the drill rod can be done by forging, machining, or grinding. Many users prefer forging, stating that it is not only more economical, but makes an extra strong connection.

It should be noted that today many mines are still using a one-use steel bit. Since the decline in metal prices, many more mines are finding that this type of bit not only lowers their drilling cost, but is very effective in performance.

In order to obtain the best drilling results with any bit, properly balanced equipment is essential. The rock drill, steel section, and bit size should be in balance.

Western Rock Bit Manufacturing Co. has close contact with drilling problems, both in mines and in construction fields. Experience has shown that no one type of bit design is suitable for every drilling condition. For this reason six different designed bits are manufactured to meet all drilling problems.

Tapered alloy drill rods for stoper steel can be prepared in two simple operations; cut-off and taper grinding. Used alloy integral steel also may be reconditioned for use with taper bits



DISCUSSION: ACCURATE COMPARISON

OF BITS DIFFICULT

By **ROBERT H. HOLSING**

Assistant Chief Engineer
Rock Bit Division
Timken Roller Bearing Co.

COMPARISON between threaded carbide bits and tapered socket carbide bits is misleading if there is an attempt to generalize. It is difficult at the present time to assemble enough data to form a broad enough basis for comparison. Comparison is only justified when limited to individual properties and in detail. There is a definite field for the use of tapered socket bits just as there is for threaded bits. Certainly the threaded bit is handicapped in its use for gauges below 1½ in. This is due to the limited body section and the small threaded pin. In spite of the handicap, threaded bits in small sizes, when used on the proper drill machines, have performed well in the past and will continue to do so. This is borne out by a number of mines which, having tested both taper and threaded, still prefer the threaded bit.

In the larger gauges there is doubt as to the ability of tapered socket bits to approach the ability of threaded bits on overall performance and positive drive, especially in broken or "rubble" ground.

Certainly there is a place for both tapered sockets and threaded bits in the wide field of mining, and the mining industry will benefit from the advantage of choice.

When comparing the results of any bit performance it must be remembered that conditions must be analyzed as to the advantages one bit design has had over another. Some of these conditions are: ore or ground formation, drilling conditions, drilling equipment, drill steel grades, constant inspection of underground steel, tolerances, quality of labor and the attitude of labor above and below ground.

Conditions being reasonable, there



Threaded, collared and heat-treated rods require complete shop equipment

is no reason long life and normal wear and tear cannot be expected of threaded and tapered socket carbide bits.

Overall experience and service records of Timken Roller Bearing Co. indicate that less than two percent of all bits used country-wide can be classed as stripped thread complaints. This has been one of the minor complaints directed towards carbide bits, generally the complaints have been to increase the life of the carbide insert. This does not mean that efforts are not being made to reduce thread stripage even more, but it must be said that at least 75 percent of the stripping complaints can be traced back to worn or improperly made drill steels.

There is no doubt that in the years ahead these same field conditions will also hamper the use of tapered connections by off-taper, short or long pins, off-center pins and worn-out tapers.

It has been brought out that there is generally considerable carbide left after the bit has been discarded for some other reason. It is a natural thing that anything as hard and durable as carbide should be the last remaining usable part of a bit. When carbide bits were first used years ago, the first thing failing was the carbide. After years of research, carbide failures have been advanced to where they equal or exceed the life of the body.

The bit manufacturer's function is to furnish any type of bit that will economically and efficiently do the work required by the bit user. There must be enough authentic demand to justify diversion of manufacturing effort and equipment. Bit manufacturers must standardize on bit connection designs, series, gauges, and types, or manufacturing costs will become so high as to put the use and manufacture of bits on an uneconomical basis.

In an effort to increase coal production and efficiency, the Russians are emphasizing mechanization. Here is a critical appraisal of Russian continuous mining machines and their possible application in U. S. mines

Russian Developments in Continuous Mining

By C. E. McWHORTER

Mining Engineer
Goodman Manufacturing Co.

IN March 1956 the Soviet Ministry of Coal Industry suggested an interchange of technical visits between Great Britain and themselves. Accordingly, with mutual agreement, the British National Coal Board sent a party of 12 technical coal experts, headed by Dr. Wm. Reid, to the Russian coal fields. Officials of all levels were contacted and numerous underground mines examined between May 14 and June 7, 1956. The report of this British Technical Mission has been published for the National Coal Board, titled *The Coal Industry of the U.S.S.R.—Part 1 to Part 4*.

It is evident that the Russians approached the problems of mechanization with a determination to increase national production and tons per man shift. Domestic coal production is extremely important to their economic growth and is already surprisingly large, as evidenced by these figures:

Production in 1955, under the responsibility of the Ministry of Coal, from ten major coal fields totaled 391,000,000 tons of which 65,000,000 tons were from open pits and 326,000,000 tons were from underground. An additional 14,500,000 tons was produced under license by local councils, bringing the total 1955 production to 405,500,000 tons.

This article will be a brief resume of the contents of the report that refers to continuous mining and loading equipment as developed and in use by the Russians at the time of the British visit, together with the

writer's understanding of the machines and comments on their possible economic value for application to U. S. underground mining conditions.

Seams as Low as 16 In. Are Mined

Coal beds now being worked are all fairly shallow, the deepest being 1200 ft. Seams are generally level and free of faults, but a few pitching seams up to 35° are mined. The seams are fairly gassy, in that the average emission in the two major coal fields from deep mines is in the order of 1750 to 3500 cu ft of methane per ton of coal produced.

Thickness of the seams being worked vary greatly. The two major coal fields are known as the Kuzbass and the Donbass. In the Kuzbass, 90 percent of the production comes from seams thicker than four ft, the average being 6.8 ft. In the Donbass, 20 percent comes from below 2½ ft,

37 percent from 3 ft 3 in., 43 percent from above 3 ft 3 in. High grade coking coal is very scarce so that seams of this material are mined as low as 16 in in thickness.

Method of working the seams is predominately longwall with only 0.6 percent recovered from room and pillar methods. Of the long face production, roughly 30 percent is retreating and 70 percent advancing longwall.

The degree of mechanization as of 1956 is reported to be 38.5 percent of all faces, being power loaded mostly with continuous mining and loading machines. There were a total of 1462 continuous mining machines in use, producing an average of 5302 tons each per month. This compares to 510 total of all types of continuous mining machines used in the United States in 1956.

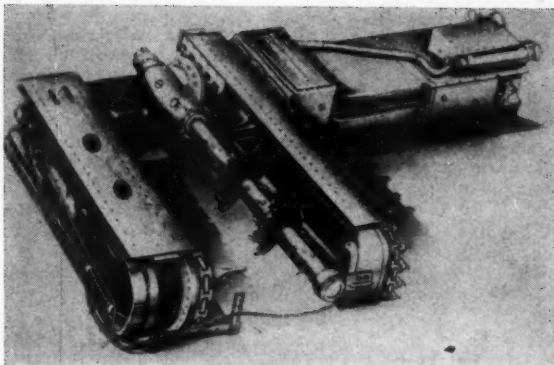
Donbass Miner for Long Face Operation Only

The most generally used machine is the Donbass of which there are four basic models. There were 959 units in use as of April 1956.

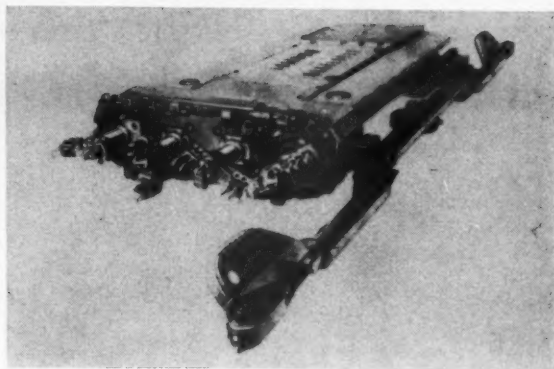
This machine is designed for long face operation only. The main body of the machine containing the motor, cutting drive gearing and feed gearing is pulled along the face by means of a feed rope with the body parallel to the face, similar to the U. S. conventional longwall undercutting ma-



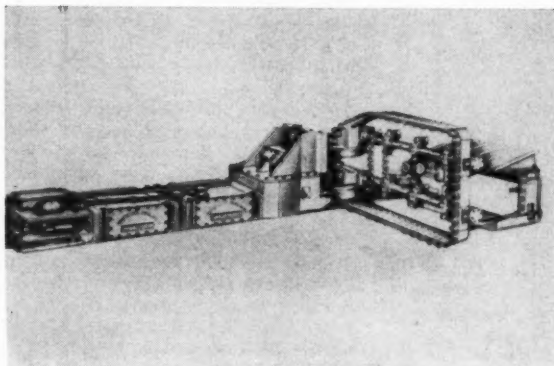
C. E. McWhorter has long been associated with mining equipment. A graduate mining engineer from the Colorado School of Mines, he spent 21 years as district manager of Western States for Goodman Manufacturing Co. Since 1951 he has been connected with the firm's home office as mining engineer responsible for new product development.



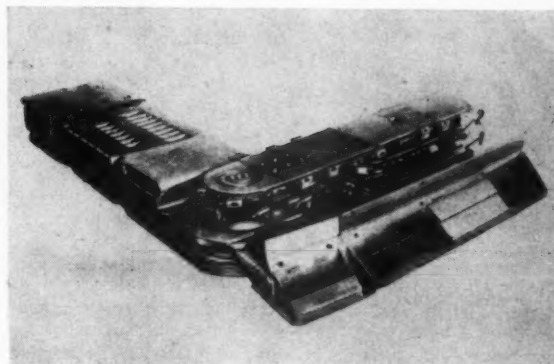
Donbass No. 1 Miner



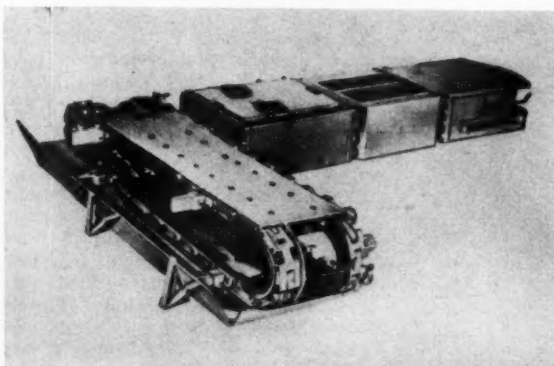
UKT-1 Miner



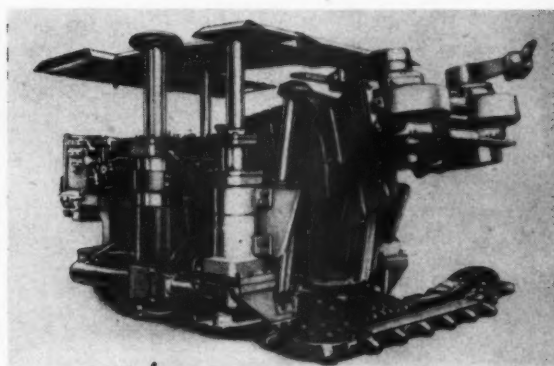
Donbass No. 6 Miner



UKMG Multi-Bar Miner



Gornyak No. 1 Miner



K-26 Cutter Loader

chine. The mining head is made up of three elements:

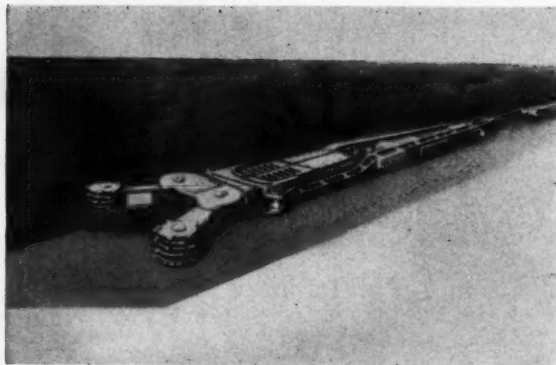
1. A cutting chain that undercuts, top-cuts and makes a vertical cut along the back of the face approximately six ft ahead of the previous face.

2. One or two rotating shafts at right angle to the long face upon which is mounted three or more discs set with bits.

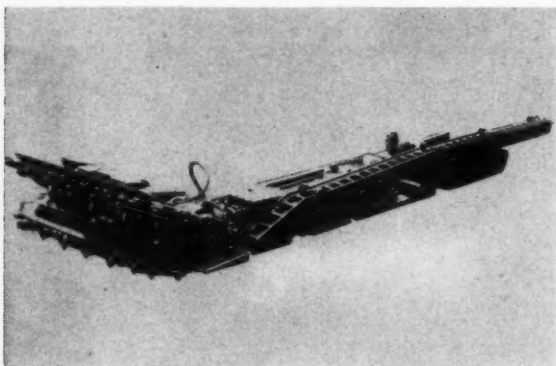
3. A coal conveying device made up of a chain flight conveyor working parallel to the cutter bars, or at right angles to the face, for conveying the cut coal past the body of the machine and up onto a long face conveyor.

The principle embodied is to completely cut loose a block of coal the thickness of the seam, and five to

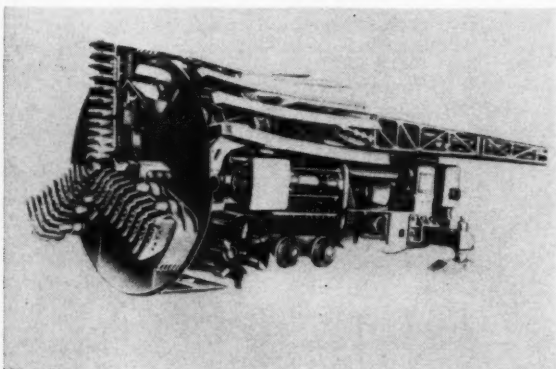
seven ft deep along the face. This block of coal is simultaneously cut up into segments by the vertical cuts imposed by the several rotating discs. The cut coal then falls backwards and onto the chain flight conveyor where it is transferred onto a long face conveyor.



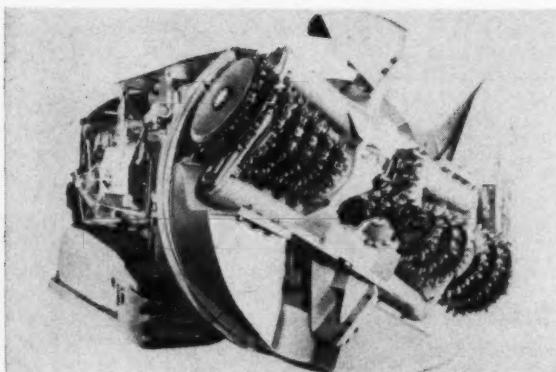
**KN-1 Coal
Heading Miner**



**KN-2 Coal
Heading Miner**



**SHBM
Tunneling
Machine**



**PKG-2
Tunneling
Machine**

Success of the Donbass is probably due to its being applied to long faces, where the coal (as in all longwall operations) is under considerable roof pressure, causing it to break up readily when cut. Power requirements are reported to be 130 hp for the cutting head and feed, and 35 hp for the conveyor.

The Donbass principle could conceivably be made to work on a room, pillar or entry driving machine for some of the softer seams mined in the United States.

Donbass No. 1 is for thin seams three to four ft in thickness, while three Donbass 6 are in use for thicker seams four to possibly 6 ft. Donbass 7 appears to be a standard Donbass 6 with the addition of a rotary multiple disc ripper head to mine out above the top cutter bar, for seams of 5 ft or more thick. It is doubtful whether this principle would work in anything but the softer coals of the United States, but the idea of employing a rotary cutter bar above the top cutter bar is interesting and could possibly be used by us to achieve a variable height machine.

A Thin Seam Machine

There are 265 Gornyak No. 1 Miners operating, averaging 3814 tons per month each. This appears to be a thin seam version of the Donbass 1—the only discernible difference being that the rotary cutting discs are eliminated. The machine might mine 18 to 22 in. thick coal seams. The short vertical height of the cutout block probably eliminates the necessity for the rotary discs.

Anthracite Equipment

Developed specifically for hard coal and thin seams, 177 UKT-1 and 2 Miners have been built and 112 were reported as being in use as of April 1956. They are employed mostly in anthracite and the Model 1 is suitable for seams 1 ft 6 in. to 2 ft 6 in. thick.

The general principle is very similar to that used by us in boring type continuous mining machines, such as the Colmol, Twin Borer, Continuous Borer and the Union Carbide Borer. The machine employs four rotors that cut annular kerfs. It is, of course, also a longwall machine and takes a cut probably six to eight-ft wide off a long face. A trimming chain removes the cusps from the top and bottom, and presumably aids in transporting the coal laterally across the face of the machine. The rotating cutter arms also appear to help push the cut coal laterally. This machine also travels along a face conveyor laid parallel to the working face and discharges the coal up and onto this conveyor. There is no visual evidence that the cut coal passes through the body of the machine. The machine

is advanced along the face by ropes that are fixed to the face conveyor, the long bar on the side of the machine serving as a guide.

The principle employed in removing the coal from the solid is already in use in the United States and nothing appears unique in this machine that our industry could adopt.

Longwall Undercutter Type Unit

One hundred forty-two UKMG Multi-Bar Miners have been produced and 66 are in use. The unit appears to be very similar to a conventional longwall undercutter with two or more cutter bars added, and also some paddles on a vertical shaft for moving the coal laterally up and onto a face conveyor.

A Cutter-Loader That "Walks" Along the Face

The K-26 Cutter Loader is under development with one prototype model in use. It was reported that 50 units would be built in 1956.

This is also a longwall machine for use in thick seams. It "walks" along the face, being hydraulically pushed between the upper and lower support jacks which bear against the roof and floor with 30-tons pressure. The two rotating cutter heads, set with large picks, are moved vertically in the mining cycle. A conventional cutter bar and chain trim off the bottom level. The coal as mined passes through the throat, up a conveyor and is discharged laterally onto a face conveyor.

It is unlikely that this principle would produce coal fast enough for us, except possibly in our very softest measures. Again, longwall roof pressures together with the undercut probably give sufficient help to the digging picks to make the machine economical for the Russian system.

Machines for Advance Entry Work

For developing new mines and for driving headings in existing mines, several continuous mining and loading machines have been developed for advance entry work in both coal and some of the softer rock strata below or above the seam.

Said to be experimental, the KN-1 Coal Heading Miner reminds one of the Lee-Norse development of a low coal continuous mining machine as exhibited at the 1957 American Mining Congress Coal Show. It is propelled forward by a "walking" action which seems to find favor with the Russians over crawler-type propulsion. Little was learned of this machine, but it has a principle that ought to produce coal from a lot of our lower seams at a very satisfactory rate. The vertical ripper drums sump in at both ribs and are brought together in a scissors action—not unlike two of our well known ripper

heads working horizontally, instead of one working vertically.

Another model, the KN-2 Coal Heading Miner, is unique in that the main body of it moves along close to the left rib. Two parallel horizontal cutter bars and cutter chains do the mining. These are raised and lowered in an arc, the center of which is about 2½ ft back of the face. Thus each cutter bit gets a horizontal and vertical motion. This "offset" machine is interesting in that roof support can be carried on four ft from the face with the machine working. This feature is new to us and should indicate further study. The Russian version is said to drive headings in a 2 ft 3 in. seam at an average rate of eight ft per hour, and 28 ft of supported entry in a shift.

The SHBM Tunneling Machine is a rail mounted device that drives a circular arch horseshoe tunnel. There are 17 of these in operation reported as doing a satisfactory job. The one observed by the British was mining soft fireclay in which a two-ft thick coal seam lay. The entry was a ten-ft high horseshoe section to accommodate steel arch supports. Average advance was 825 ft of drift per month with a maximum of 2130 ft of supported tunnel in one month.

The SHBM reminds the writer of the Robbins Tunnel Boring machine used in the Oahe Divergence Tunnels. The one 3-arm rotor turning at 6.6 rpm carries a number of cutter arms set with tapered shank bits. Annular kerfs are cut and the cores are pressed off by wedges. The lower right and left hand corners are cut out vertically with additional cutting wheels. Cut material is picked up by buckets attached to the arms and discharged onto a conveyor. The machine body is jacked against the ribs and the cutting head is pushed

ahead by hydraulic jacks. Spring steel shrouds serve as temporary roof support.

Another tunneling machine, the PKG-2, was in the stage of development. It is similar to the SHBM in shape and size of opening driven. The main difference is that the head is fitted with two power rotated drums, fixed with a number of discs in which are mounted cutter bits. The rotor head turns at six rpm and the rotating discs at 45 rpm. The whole machine is crawler mounted. No figures are available on its performance, but the principle of two conventional type ripper heads being rotated to cover a circular face is most interesting.

Some Ideas Show Inventive Promise

In conclusion, while the Russians have made great progress in developing machines for coal, they are practically all for longwall application. They apparently believe that longwall systems are to be favored over room and pillar, although their depth of cover over most seams is not reported as being much more than ours. Longwall systems require a great deal of temporary roof support along the faces. This work has always required excessive labor, accounting for high cost. However, the Russians are expending a great deal of time, money and energy in an attempt to mechanize roof control of long faces. The British report shows that many ideas are being experimented with and some show inventive promise. It will be well for us to watch this phase of their development, as they might come up with ideas for roof support that would control long face work with very little labor. If they do, longwall mining could conceivably show an improved cost over our best room and pillar results.

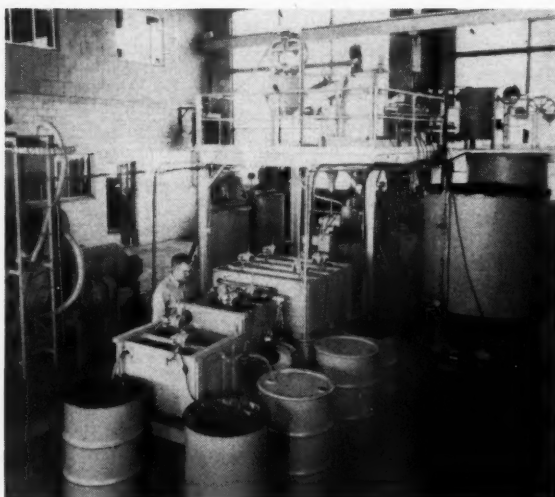


"At the present time we're working with a skeleton crew."

SOLVENT EXTRACTION

for Recovering Uranium

Figure 1. Solvent extraction unit in uranium pilot plant. Partitioned tank-type contactors employ a dual role impeller in each stage for mixing and pumping. A 4-stage extractor, 3-stage stripper, and 2-stage scrub unit are shown. Leach tanks and thickeners are in background



Flexibility . . .
Rapidity . . .
Economy . . .

By J. B. CLEMMER, Chief

J. B. ROSENBAUM, Supervising Metallurgist

and J. R. ROSS, Metallurgist

Division of Mineral Technology U. S. Bureau of Mines, Region III



J. B. CLEMMER



J. B. ROSENBAUM



J. R. ROSS

SOLVENT extraction in metallurgy is a new unit operation of exceptional promise. As such, it has become a favorite topic in recent technical meetings of mineral-industry groups. In view of the several reports describing commercial solvent-extraction installations and different research phases that have appeared in the past several months, the material for this paper has been sifted to minimize repetition while compiling an up-to-date summary of uranium solvent extraction. A selected bibliography of technical reports is included for those desiring more background information on solvent-extraction processing of uranium ores.

Solvent Extraction Defined

Broadly defined, solvent extraction is a procedure for separating components of a liquid solution by creating a two-phase system with the help of an auxiliary immiscible liquid that

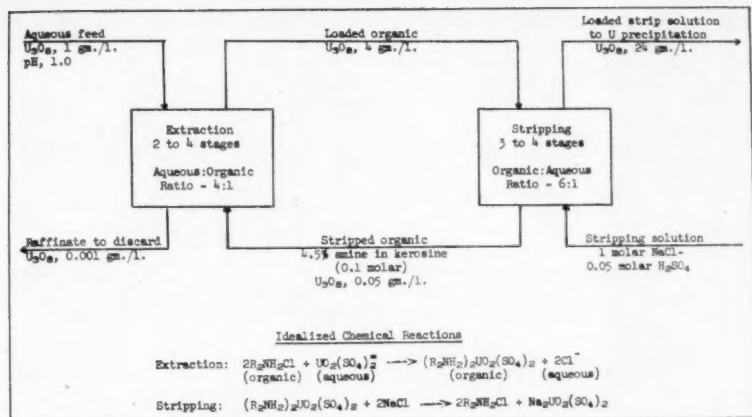


Figure 2. Typical flowsheet for amine extraction and salt stripping

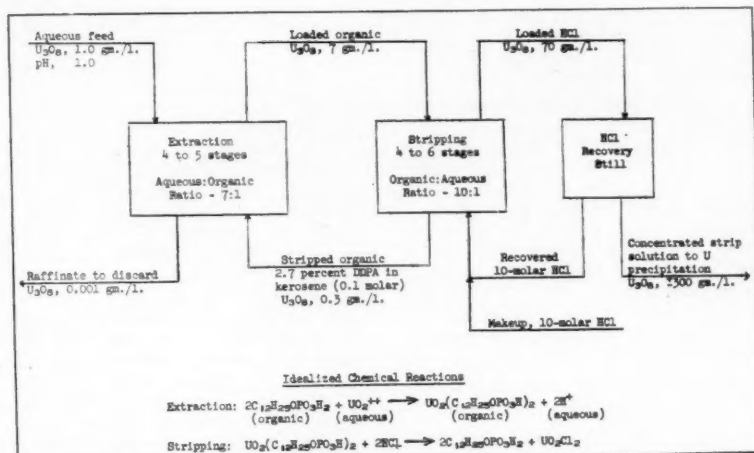


Figure 3. Typical flowsheet for dodecyl-phosphoric acid extraction and hydrochloric acid stripping

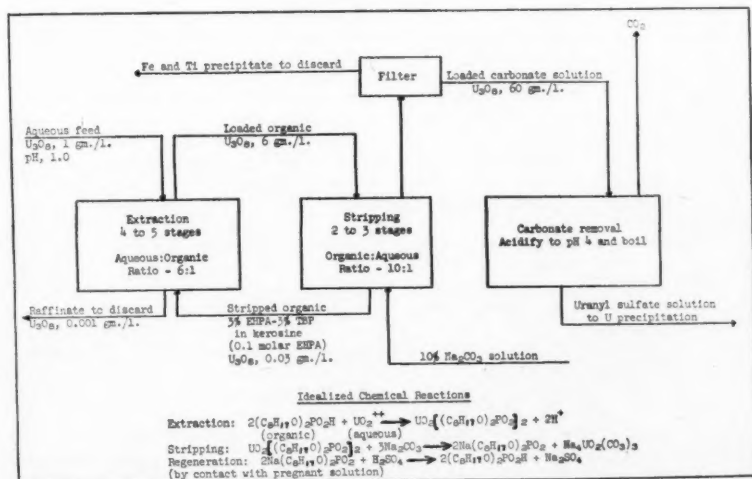


Figure 4. Typical flowsheet for di 2-ethylhexyl phosphoric acid extraction and sodium carbonate stripping

has a specific affinity for one or more of the constituents. In uranium metallurgy the method involves contacting the aqueous leach liquor or pulp with an organic extractant dissolved in a suitable carrier, such as kerosene. The uranyl or uranyl sulfate ion transfers from the aqueous into the organic phase, and the phases are then separated to give a loaded organic and a barren aqueous raffinate. This is the extraction step. The loaded organic then is recontacted with another suitable aqueous solution that removes the uranium from the organic, and the two phases again are separated. This is the stripping step. The combined operation gives a raffinate for discard or subsequent additional processing, a loaded strip liquor containing the uranium in a concentrated and purified form, and regenerated organic for reuse in the extraction step.

The ability to tailor make reagents for specific constituents gives solvent extraction broad versatility in extractive metallurgy. Since solvent extraction must compete with other uranium recovery procedures, such as chemical precipitation or ion exchange, commercial adoption depends upon lower capital or operating costs, better recovery, or higher product purity. There is a definite trend toward solvent extraction in uranium hydrometallurgy. Because of simplicity and versatility, coupled with low capital installation and operating costs, solvent extraction may replace ion exchange in processing clear liquor from certain ores. Chemical precipitation already has been replaced in several plants, and column ion exchange for processing clear liquors seems to be losing its preferred position in the United States. Although solvent extraction appears technically feasible for processing dilute slurries and thick leach pulps, process economics favor a prior solid-liquid separation because of high loss of the organic extractant in the tailings.

Similarity to Resin Ion Exchange

The basic steps and chemistry in recovering uranium by solvent extraction closely parallel resin ion exchange. In fact, solvent extraction quite properly has been called "liquid ion exchange." Certain of the long-chain amines and organophosphates exhibit reactions typical of the anion and cation exchange resins. In extraction with an organophosphate, the uranyl cation (UO_2^{++}) in the aqueous solution exchanges with two hydrogen ions of the organophosphate, whereas with an amine extractant the uranyl sulfate anion ($UO_2(SO_4)_2^{--}$) exchanges with two chloride or sulfate ions. This corresponds to the resin loading cycle. In stripping the loaded organics with hydrochloric acid or a sodium chlo-

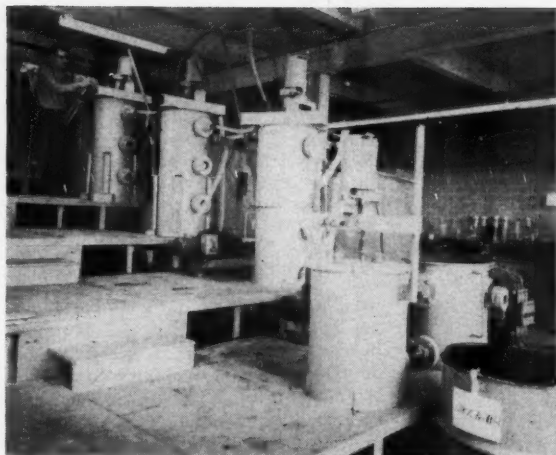


Figure 5. Three stages of internal-mixer contactors and a single stage mixer-settler processing uranium leach solution by amine extraction and caustic stripping

ride solution, as the case may be, the exchange reaction is reversed to regenerate the extractant and give an aqueous solution containing uranyl chloride or sodium uranyl sulfate. This step corresponds to the elution cycle in resin ion exchange. Although the reactions in resin ion exchange and solvent extraction are similar, solvent extraction proceeds at a faster rate because of the larger interfacial surface created by intimate mixing of the organic and aqueous phases in a mechanical contacting device of one kind or another.

To illustrate the rapidity of the solvent-extraction reaction as compared with resin ion exchange, one cu ft of resin that can be loaded with three to five lb of U_3O_8 ordinarily produces two to three lb of U_3O_8 a day, whereas one cu ft of 0.1 molar organic extractant that can be loaded with only $\frac{1}{4}$ to $\frac{1}{2}$ lb of U_3O_8 ordinarily produces four to eight lb of U_3O_8 a day. A cu ft of resin costs about \$45, whereas a cu ft of 0.1 molar organic costs \$3 to \$4.

Pilot Plant Testing

Bench-scale research by the Dow Chemical Co. for the Atomic Energy Commission, laid the groundwork for recovering uranium from sulfate systems, using various organic phosphates as the extractants. The laboratory work was so encouraging that pilot-plant testing seemed warranted to prove the process under continuous operating conditions. The Intermountain Experiment Station's favorable location, the presence of supporting facilities, and availability of a technical staff experienced in uranium raw materials research led to selection of the Bureau's station as the pilot-plant site by the Commission. (Part of the plant is shown in Figure 1). A continuous test unit having a capacity of up to three gpm of pregnant liquor was put into operation in June 1954. The plant has been operated almost continuously since that time in cooperation with research

personnel of Dow. As originally designed, the plant employed mixer-settlers for extracting uranium from clear or turbid pregnant liquors using dodecyl phosphoric acid (DDPA) dissolved in kerosene as the extractant. More recently di 2-ethylhexyl phosphoric acid (EHPA) and a secondary amine (Rohm-Haas 9D-178), suggested by studies of the Oak Ridge National Laboratory which is operated by the Union Carbide Nuclear Co., were tested in the pilot plant. Other organophosphate esters and various secondary and tertiary amines are under study in the laboratory and later will be tested in the pilot plant as justified by the bench-scale results.

Factors Relating to Extractant Selection

A preliminary appraisal of different organic compounds shows that several organophosphates and amines are good extractants for uranium, but each has different selectivities and handling characteristics. The amines are the most selective and quickest acting. The loaded amines can be stripped with soda ash, acidified salt solutions, or dilute acids. A 1-molar solution of sodium chloride acidified to a pH of 1, for example, can be used to strip uranium and simultaneously regenerate the amine for reuse. Direct precipitation of the uranium from the loaded amine by addition of NH_3 or MgO may be practicable, provided present filtration difficulties can be overcome. The amine is selective enough for uranium over ferric iron that prereduction of the solution is unnecessary. The phase-disengagement rate of the amine is fairly good provided the aqueous solution is dispersed into a continuous organic phase during the extraction step. Amines loaded with uranium show faster phase-disengagement rates than a barren amine. Low pH and moderately high temperature favor rapid phase disengagement. Use of petroleum frac-

tions lighter than kerosene as the carrier also improves the phase separation rate. The principal disadvantage of amines is that a clarified pregnant solution is obligatory for processing. Solids cause formation of an emulsion that presents a handling problem and contribute to loss of the extractant. The mill of the Texas Zinc Minerals Co. at Mexican Hat, Utah, uses a secondary amine extractant. A tertiary amine is slated for use in the first solvent-extraction plant in Canada, being built at Port Hope by Eldorado Mining, Ltd.

Dodecyl phosphoric acid (DDPA), although rapid acting, requires slightly more mixing time than the amines for an equivalent extraction. It is the cheapest of the extractants and gives the highest ratio of concentration from pregnant to strip solution. A considerable quantity of solids can be tolerated in the pregnant solution without adversely affecting operations or causing excessive reagent loss. The phase-disengagement rate and the influence of pH, temperature, uranium loading, and carrier on phase separation are about the same as for amines. DDPA is less selective than amine and extracts appreciable ferric iron and any titanium present in the pregnant liquor. The titanium will build up and subsequently reduce the uranium loading capacity of the phosphate. Titanium in the organic must be removed by periodic stripping with a 10 percent solution of hydrofluoric acid to regenerate the extractant. Owing to the tenacious binding of the uranyl ion with the organophosphate, a powerful stripping solution such as 10-molar HCl is needed. Subsequent distillation of the loaded HCl will recover about 80 percent of the acid for reuse and give a solution containing 300 to 600 grams of U_3O_8 per liter.

Vitro Uranium Co.'s new solvent-extraction plant in Salt Lake City uses DDPA extraction and HCl stripping. A similar system is used in the Vitro plant at Canonsburg, Pa., for processing residues from uranium refineries.

The di 2-ethylhexyl phosphoric acid (EHPA) requires longer contact time and more intensive mixing than DDPA or amine extractants, but phase separation is faster. The influence of pH, temperature, and carrier on phase disengagement is about the same as for the other extractants. However, the phase separation rate slows down with the uranium loading. Selectivity of EHPA lies between the amines and DDPA. The loaded EHPA can be stripped by strong acids or by a 10-percent soda-ash solution, provided three to five percent of tributyl phosphate or certain long-chain alcohols, such as capryl or undecanol, are added to the kerosene solution. These additives prevent

formation of an insoluble third phase when the EHPA is stripped with soda ash. The alkaline strip removes any iron, titanium, or molybdenum picked up in the extraction step. Iron and titanium precipitate as hydrates in the strip solution and must be removed by filtration. Theoretically, uranium can be recovered from the loaded carbonate solution by conventional precipitation with caustic soda, which in turn allows the filtrate to be carbonated for reuse in the stripping step. In the pilot plant, however, filtration difficulties made this method unworkable. It was necessary to destroy the carbonate by acidification to a pH of 4 followed by boiling to expel CO_2 . Uranium then was precipitated by neutralization with ammonia or magnesium oxide.

Climax Uranium Co. at Grand Junction, Colo., and the Navajo Uranium Division of Kerr-McGee Oil Industries at Shiprock, N. Mex., now recover uranium from sulfuric-acid leach solutions by extraction with di 2-ethylhexyl phosphoric acid. Kerr-McGee also employs this extractant for commercial recovery of vanadium from the uranium waste liquor. EHPA is slated for use in recovering uranium and vanadium in Union Carbide Nuclear's new plant at Rifle, Colo.

Difficulties Caused by Other Metals

All amines and organophosphates tested to date extract molybdenum about as well as uranium. The loaded organics, however, can be selectively stripped to separate the uranium and molybdenum. Salt stripping removes uranium from the amines and leaves molybdenum, which subsequently can be removed by a carbonate or caustic scrubbing step. Molybdenum can be selectively removed from the loaded organophosphates by scrubbing with dilute oxalic acid before stripping for uranium. An alternative procedure being used on high molybdenum ores is to precipitate the molybdenum from the pregnant leach solution with hydrogen sulfide before solvent extraction. This treatment simultaneously reduces any dissolved iron to the ferrous state to minimize iron pickup when the organophosphate extractants are used. Molybdenum also can be selectively removed from sulfuric-acid leach liquors by adsorption on activated carbon before solvent extraction for recovery of uranium.

Presence of thorium in uranium leach liquor complicates solvent extraction processing with the organophosphates. DDPA, for example, extracts thorium along with uranium. Since thorium is not removed in the HCl stripping step, it builds up in the extractant and reduces the uranium-loading capacity. When enough is present to cause trouble, the thorium can be removed by a periodic oxalic- or hydrofluoric-acid scrub.

The amines exhibited low extraction coefficients for thorium, and no difficulty has been encountered with a buildup of thorium.

Vanadium has given no trouble in pilot-plant processing a wide variety of uranium ores by amine or phosphate extraction. The vanadium in sulfuric acid leach solution ordinarily is present as V^{+4} , which is not extracted by the amines. Only a small quantity of vanadium is extracted by the 0.1-molar solution of organophosphates normally used for uranium extraction. Should enough vanadium be present to warrant recovery, the uranium raffinate can be reprocessed with a 0.4-molar solution of the organophosphate for the vanadium. Alternatively, the solution can be treated with sodium chlorate to oxidize the vanadium to the V^{+5} form for extraction with an amine.

Important Extractant Characteristics

Flowsheets for the different extractants are given in block diagram form in Figures 2 to 4. The chemical reactions in simplified form for extraction and stripping are included with the flowsheets.

Recent laboratory work by the Bureau of Mines at Salt Lake City has demonstrated that combinations of amines and organophosphates have provocative possibilities for coextraction of uranium and vanadium. Under certain conditions several of the mixtures display a synergetic effect that results in higher uranium and vanadium extraction coefficients than are obtainable by the separate extractants. Presence of the amine appreciably reduces extraction of ferric iron by the organophosphate. Additional research is in progress on applications of combination extractants.

The more important characteristics of a useful extractant are satisfactory selectivity and capacity for uranium, reasonable price and availability, sufficient miscibility in a suitable organic carrier such as kerosene, low solubility in the aqueous solution, rapid and complete disengagement of the organic and aqueous phases, and compatibility with practical stripping procedures. Nontoxicity, low volatility, and nonflammability of the organic and carrier also are desirable but not obligatory.

Considerations in Equipment Selection

The aqueous and organic phases can be contacted and separated in a multiplicity of ways. Among the many interrelated factors that influence choice of solvent extraction equipment are the time and intensity of mixing, the in-phase mixing ratio, the phase-disengagement rate, stage efficiency, and the number of stages required for extraction. Volatility, toxicity, and corrosiveness of the reagent and carrier, reagent inven-

tory and cost, and permissible temperature gradients are other factors that must be considered in selecting the contacting device. Mixer-settlers, pump settlers, pulse columns, rotating disk contactors, cyclones, and internal mixer contactors have been tested in the pilot-plant to determine their relative advantages and limitations. (See Figure 5). Mixer-settlers are used by Climax and are being installed at Rifle by Union Carbide Nuclear. Internal-mixer contactors are used in the uranium circuit at Shiprock and have been installed in Vitro's plant at Salt Lake City.

Centrifugal contactors for multi-stage extraction are gaining favor for some applications because of the small floor space and low organic inventory required. Such contactors are being used for recovering uranium from phosphoric acid and have been provided for the mill at Mexican Hat, Utah. Kerr-McGee has pioneered a multiple-stage contactor comprised of adjacent mixer-settlers made by partitioning a standard wooden thickener. This type unit is used in the vanadium circuit at Shiprock. Airlifts were used to transfer the mixed phases to the settlers. A modified design developed at Salt Lake City for laboratory and pilot-plant work employs an impeller for the dual purpose of mixing and pumping. Weirs are used for setting the levels in the settlers and once established need not be changed. The units are simple and cheap to construct, easy to operate, and can be reliably scaled-up to commercial size.

Selection of the contactor depends on whether clear liquors or slurries are to be processed. Experience has shown that most types of contactors can be used for processing clear liquor, whereas the choice is limited when processing leach slurries. Since the possibility of obviating a liquid-solid separation is particularly attractive, a brief discussion of slurry extraction is appropriate. When clear liquor is processed, loss of extractant in the raffinate is small, whereas an appreciable loss may result in processing leach slurries depending upon the conditions established and the type of contactor employed. Limiting the organic entrainment loss in the raffinate to an acceptable figure is the prime goal of current research in extracting slurries. Laboratory and pilot-plant work at Salt Lake City has shown that desanded uranium leach slurries, containing about five percent solids, can be processed with an organic loss of about one gal per ton of original feed when DDPA is used as the extractant. On an average ore, containing five pounds of U_3O_8 per ton, this loss of organic amounts to about \$0.06 per pound of recovered U_3O_8 .

Some factors that influence organic entrainment when slurries are proc-

essed deserve mention. Mixing should be just adequate to give extraction, as entrainment increases with intensity of mixing. The ratio of organic to aqueous during mixing must be high to minimize emulsion formation and loss of organic. Several organic sulfonates that lower the surface tension of the slurry have proved beneficial for reducing entrainment on certain ores.

Prebaking the ore at temperatures under 400° C to destroy the hydrophilic properties of certain clay minerals also has been helpful for reducing entrainment on slimy ores. Although the permissible pulp solids vary from ore to ore, entrainment invariably increases with solids content of the slurry.

Provided the organic loss in the raffinate can be kept low enough, direct extraction of thick slurries by eliminating thickeners, filters, or a sand-slime separation in the flow-sheet. A single extraction of a leach slurry containing 50 percent solids may result in the prohibitive loss of 10 to 20 gallons of organic in the raffinate. From 75 to 90 percent of this organic can be recovered by diluting the raffinate to 20 or 30 per-

cent solids for separation by partitioning and filtration. By avoiding dropwise dispersion of the pulp encountered in usual contacting devices, organic entrainment can be almost completely prevented but the extraction rate becomes prohibitively slow. The search for an intermediate ground where entrainment will be low enough and extraction will be high enough to give a practical method for direct extraction of thick slurries during or after leaching is continuing.

This thumbnail sketch presents only the highlights of recent work with organic solvents. It hints of the inherent flexibility and potentially numerous applications of solvent extraction in processing uranium and other ores. Solvent extraction seems destined to become an important unit operation in extractive metallurgy.

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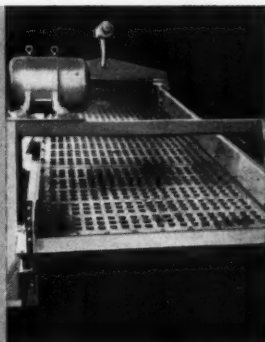
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Operators' Corner

Lamp Room

Goes Underground*

SERVICE, safety and production go hand in hand at The New Jersey Zinc Company's Eagle Mine, Gilman, Colo., 112 miles west of Denver.

Much of the service at this Empire Zinc Division mine is done underground, where the cap lamp room and other facilities are located.

Approximately 1000 tons of zinc ore and 150 tons of copper-silver ore are produced each working day by 500 men employed in three shifts.

Mineral deposits were first discovered in the Gilman district in 1879 and have been worked continuously since 1915 when New Jersey Zinc acquired all area mine interests of The Empire Zinc Co. An underground flotation mill for concentration of zinc ores was constructed by 1929. Zinc ore has accounted for most of the area's mineral mining, except for a ten year period ending in 1941 when copper and silver ores were mined extensively.

Playing a major role in this production story is the plant service department which, in addition to shop and repair facilities, is also responsible for distribution of power for the operation, compressed air for mine and mill, water for use in the mine, mill and community, fire protection, sewage disposal, and general construction and maintenance of buildings and housing.

Typical of these service features is the cap lamp charging and repair station, located at the 16th level—427 ft below the No. 1 shaft collar.

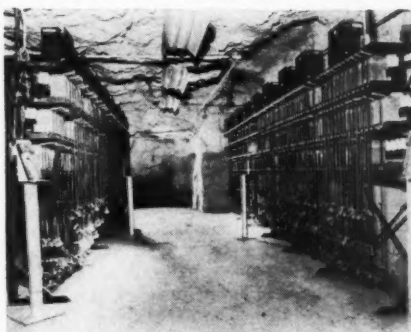
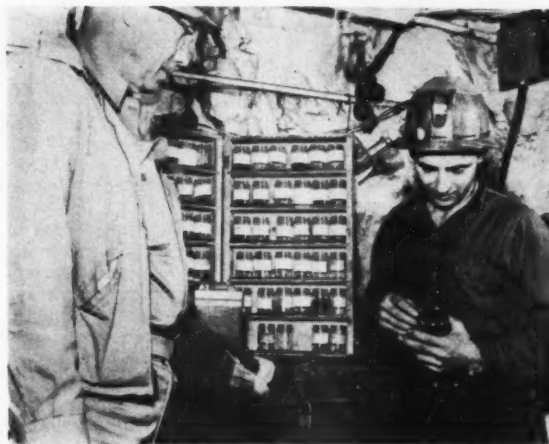
The installation houses 475 electric cap lamps and ten trip lamps, used by approximately 125 men on each shift.

W. L. Jude, general superintendent of the Empire Zinc Division, said this 15 by 40-ft cap lamp room is located underground "for convenience, economy and speed in getting miners to their working places. Under this arrangement the cap lamp room attendant can also service locomotive batteries and make minor electrical repairs throughout the mine."

Each individual using a lamp is assigned one by number and is responsible for that particular lamp.

* Courtesy of Mine Safety Appliances Co., Pittsburgh, Pa.

On-the-spot facilities play an important role in high production marks



Electric cap lamps are charged and serviced in this 15 by 40-ft underground room of The New Jersey Zinc Company's Eagle Mine



The room in which these lamps are stored is 427 ft below the No. 1 shaft collar of this zinc operation. Storage of the lamps in the underground location provides convenience, economy and speed in getting miners to their working places

wheels of government

As Viewed by HARRY L. MOFFETT of the American Mining Congress

THE Second Session of the 85th Congress, beset by even more problems than usual in an election year, may not adjourn until as late as August 15, according to recent forecasts. Many knotty problems remain to be solved, and furious debate is expected on controversial issues such as extension of the Trade Agreements program, reorganization of the Defense Department, expansion of the unemployment compensation program, and national minerals policies including the so-called Seaton plan. Congress must act also on several major appropriations bills.

President Eisenhower is being urged to put into effect the recent recommendation of the Tariff Commission that higher rates of duty be imposed on imported lead and zinc, but it is generally believed that he will await the outcome of Congressional action on the Seaton plan before making any move.

Congressional and industry supporters of increased restrictions on imports of oil and oil products (residual fuel oil), copper, lead, zinc, fluorspar and tungsten continue to wage a strong battle, but the outlook is not too encouraging. Meanwhile, important segments of the domestic mining industry are being harmed by excessive and unneeded imports.

TRADE ACT GETS BOOST

Despite the rising tide of protectionist sentiment this year in Congress, the House Ways and Means Committee has approved a five-year extension of the Trade Agreements program in virtually the same form as proposed by the Administration, including authority to cut tariffs another 25 percent.

Minor revisions only were accepted by the Committee. Designed to appease opponents of the program, these amendments would (1) provide a theoretical check on Presidential vetoes in escape-clause cases by permitting them to be overridden by a two-thirds vote of both Houses of Congress, and (2) set up more specific criteria for the Office of Defense Mobilization and the President to follow

in cases where it is charged that imports are threatening to impair the national security.

Prior to action on the Trade Act bill, the Committee defeated an attempt by 10 of its 25 members to attach a mineral commodity amendment. Sponsored by Rep. Ikard (Dem., Tex.), this amendment would have imposed quota limitations on

who have been damaged by excessive imports.

Rep. Reed (Rep., N. Y.), ranking minority Committee member, termed the two-thirds vote veto power for Congress a "phantom gimmick," and other Congressmen generally agreed that it would be impossible in any escape-clause case to muster the two-thirds majorities needed to override the President.

Opponents of the trade program immediately announced that they would seek a parliamentary situation on the House floor under which they could offer a substitute bill extending the Act for only two years, requiring the President to effectuate escape-clause recommendations of the Tariff Commission unless specifically authorized by Congress to take other action, and making other substantive changes aimed at helping domestic industries.

SEATON PROPOSES MINERALS SUBSIDY

After months of prodding by the Senate Interior Committee, the Administration late in April came up with a Domestic Minerals Stabilization Plan under which domestic producers of copper, lead, zinc, acid-grade fluorspar and tungsten would be eligible for "stabilization" payments over a five-year period. The proposal, presented to the Committee by Secretary of the Interior Fred A. Seaton, also calls for enactment of legislation extending the soon-to-expire loan program conducted by the Defense Minerals Exploration Administration, and possible later recommendation that Congress relax the present four-year, \$100,000-per year limitation on the expensing of exploration costs.

The plan contemplates the setting of stabilization prices for specified annual quantities of the five minerals covered, with the Government paying producers the difference between the domestic market price and the stabilization price in each case as follows: Copper, 27.5c a pound, 1,000,000 tons; lead, 14.75c a pound, 350,000 tons; zinc, 12.75c a pound, 550,000 tons; acid-grade fluorspar, \$48 a short ton, 180,000 tons; and tungsten, \$36 a short-ton unit, 375,000 units.

Seaton testified that the President has endorsed the plan and that it will



Washington Highlights

CONGRESS: August adjournment seen.

TRADE ACT: House floor battle in prospect.

MINERALS PROGRAM: Subsidy plan offered.

MINING MEASURES: Active in Senate.

LABOR LEGISLATION: Senate Committee drafting bill.

UNEMPLOYMENT COMPENSATION: Benefits bill in upper House.

PREMERGER NOTIFICATION: Sponsors reach accord.

COAL LEASES: Acreage increase approved.

URANIUM SALES: New policies announced.

COAL RESEARCH: Legislation stalled.

STOCKPILES: Upgrading urged.

BARTER PROGRAM: Expansion opposed.



imports of crude and residual oil and fluorspar, and placed a 4-cents-per-pound import excise tax on copper, lead and zinc whenever their respective prices per pound fell below 30 cents, 17 cents and 14½ cents—with no tax when prices were at or above these levels.

Also defeated were attempts to give aid to domestic producers of other minerals, including tungsten,

provide "immediate assistance" to the industries involved "with a minimum of interference with them or to our friends and neighbors in other nations." He estimated the first year's stabilization payments at \$161 million, with diminishing cost thereafter. He said that a draft of legislation embodying the program would be submitted soon, but three weeks later the Department had not yet forwarded it.

Western Senators, many of whom are members of the Interior Committee, were less than pleased with the Seaton plan. Some of them, along with industry witnesses, pointed out that recent experience indicates Congress is not always willing to make the necessary appropriations to implement minerals programs. Spokesmen for the copper, lead and zinc mining industries also reiterated their belief that a peril-point, on-and-off excise tax system would be a far more satisfactory solution, both here and abroad, to the problem of excessive and unneeded imports.

These witnesses and others told the Committee that they would reserve detailed comment until they could examine a draft of specific legislation to institute the program.

MINING MEASURES INTRODUCED

A bill to implement a noncontroversial recommendation of the Interior Department—establishment on a permanent basis of the minerals exploration loan program heretofore conducted by DMEA—has been introduced by Senator Murray (Dem., Mont.), chairman of the Senate Interior Committee. The measure does not contain the so-called "pauper's oath" requirement which the Administration recommended last year, but it would limit any single exploration project to not more than \$250,000, including Government participation therein. Its chances of enactment are considered excellent.

Another measure introduced by Senator Murray would provide incentive payments to domestic producers of beryl concentrates, metallurgical chromite, and columbium-tantalum concentrates, to become effective when present Government purchase programs covering these minerals expire. Although the bill does not so specify, payments presumably would be made to producers on minerals sold on the open market.

Payments would be made as follows: For beryl, \$100 per short ton, not to exceed 4,000 tons annually and limited to 400 tons per producer; for chromite, \$46 per long dry ton, not to exceed 100,000 tons annually and limited to 15,000 tons per producer; and for columbium-tantalum, \$2.35 per pound, not to exceed 150,000 pounds annually and limited to 20,000 pounds per producer.

It is expected that the Senate Interior Committee will hold hearings

on both measures prior to taking any further action.

Two other measures of interest to the mining industry have passed the Senate. One of these would change the date for performance of labor on mining claims from July 1 to September 1 of each year, and would also suspend the required assessment work for the year ending July 1, 1958. There appears to be some chance that this measure will be voted upon in the House. The other Senate-approved measure would extend until December 31, 1959 the domestic producers programs for asbestos and fluorspar. Some funds are available for purchasing these minerals.

LABOR HEARINGS CONCLUDED

The Senate Labor Committee has concluded hearings on several bills providing for correction of abuses revealed by the McClellan "Rackets" Committee, and a bill was to be reported to the Senate by June 10.

Secretary of Labor Mitchell and AFL-CIO President Meany were the final witnesses at the hearings. Mitchell urged immediate action on Administration recommendations to provide "needed protection to the rights of individual workingmen and women." Among these recommendations are a limitation of organizational picketing, revision of secondary boycott provisions, and clarification of the so-called "no man's land" which results when the National Labor Relations Board refuses to consider a case and the States are precluded from assuming jurisdiction. The Administration also favors the registration of welfare and pension plans, annual filing of financial reports, new criminal penalties covering embezzlement and falsification of records, and more stringent bribery penalties.

Meany, who earlier clashed with Kennedy on the need for any corrective action on labor abuses, was docile in his second appearance and listed several fields in which action could be taken. He said that the noncommunist oath requirement of Taft-Hartley should be repealed and that the "no man's land" should be clarified.

UNEMPLOYMENT COMPENSATION HEARINGS CONCLUDED

The Senate Finance Committee has completed hearings on a bill which would provide for extended unemployment compensation for workers who have exhausted their benefits under State laws. The bill was passed by the House after being considerably "watered down" by amendments proffered by Representatives opposed to the Federalization of the unemployment compensation program.

The bill as reported to the House provided for mandatory Federal grants to States to finance a 16-week extension of benefits, both to work-

ers who had been covered by the State unemployment compensation program and others who had not been covered. As the bill passed the House, it provides for optional Federal loans to States, on their request, for the extension of benefits. The duration of the extended benefits would be equal to one-half the entitlement under the State laws, and would apply only to covered workers. The program would be retroactive to cover workers who have exhausted their benefits since July 1, 1957, and would extend through April 1, 1959. The funds would be repaid by the States any time up to 1963. If a State fails to repay the loan by 1963, the Federal unemployment compensation taxes on employers in the State would be increased to pay off the loan.

Secretary of Labor Mitchell said the Administration would accept the bill as passed by the House. He was immediately challenged by Senator Douglas (Dem., Ill.) who said the bill was unworkable. Douglas said that he had polled all the Governors and that among the replies he had received, a majority felt that the bill would not be effective without special State legislative action. Senator Byrd (Dem., Va.), chairman of the Finance Committee, stated his opposition to any steps which would Federalize the unemployment compensation program, saying "I just can't understand why the States can't take care of themselves instead of coming to the Federal Government. They have far less debt and lower deficits than the Federal Government." He also said that if the unemployment insurance system is once Federalized "it will never again be free." He challenged anyone to point to any Federal grant program that did not carry Federal control.

Representatives of business and labor testified on the bills. Generally the labor representatives felt the bill did not go far enough, in that non-covered workers who are unemployed are given no relief. Business representatives testified the bill was not needed and that by increasing the employers' tax to pay back Federal loans, the Government was in effect making the business community finance the recession.

PREMERGER NOTIFICATION

Senators Kefauver (Dem., Tenn.) and O'Mahoney (Dem., Wyo.), authors of two Senate bills calling for premerger notification, have tentatively agreed to accept a House version of the bill containing a series of exemptions—including an exemption for acquisitions of undeveloped and partially developed mining properties.

The Senate Antimonopoly Subcommittee has concluded brief hearings on the legislation. At these a representative of the American Mining

(Continued on page 107)

personals

J. D. MacKenzie has been elected president of American Smelting and Refining Co., and **R. W. Vaughan**, formerly president, has been elected vice chairman of the Board.



J. D. MacKenzie

MacKenzie has come up through the ranks from a chemist and metallurgist at the company's Utah facilities, which he joined in 1920. During his 38 years with Asarco, he served as manager of several smelters and refineries in the United States and as a consultant to the Peruvian operations. In 1948, he was made vice president in charge of all smelting and refining operations and was elected a director the following year.

Vaughan, the new vice chairman of the Board, joined Asarco in 1937 as assistant general counsel. He moved up to vice president and general counsel in 1947 and was elected a director the following year. In 1957, he became president of the company.

The election of **R. L. Jourdan** as vice president of Asarco has also been announced. He began his work for the company in 1922 as a chemist and metallurgist and has been manager of the Ore Purchasing Department since 1941.



J. D. Bradley

John D. Bradley, president of The Bunker Hill Co., has been elected president and chairman of the board of the Lead Industries Association. The Association represents major lead producers and consumers in this country, as well as major foreign producers in the free world. It has recently embarked upon a world-wide research program to discover new uses and expand existing markets for lead.

Jack O. Horton, general manager of Vitro Minerals Corp., has resigned to become a minerals consultant in Salt Lake City. Horton will be succeeded as general manager of Vitro Minerals by **Charles J. Potter** of Indiana, Pa., president of Vitro Minerals and head of Rochester and Pittsburgh Coal Co. Potter was also elected to Vitro's board of directors. **Gavin**

Young of Price, Utah, who for the last eight months has been in charge of deep mining for Vitro, was named assistant general manager.

The Anaconda Co. has announced several major executive changes.



C. L. Weed

Clyde E. Weed, formerly president has been elected chairman of the board and chief executive officer of The Anaconda Co., Chile Copper Co., Chile Exploration Co. and Andes Copper Mining Co. He succeeds **Roy H. Glover** who died March 31st.



C. M. Brinckerhoff

Charles M. Brinckerhoff has been elected president and director of the same companies. Until now, **Brinckerhoff** has been executive vice president of the latter two named Anaconda subsidiaries. **C. Jay Parkinson**, general counsel of Anaconda, has been



N. F. Koepel

elected vice president. **Norbert F. Koepel** has been elected vice president of Chile Exploration and Andes Copper. **Koepel** was formerly assistant to the vice president of these two subsidiaries. **Richard S. Newlin**, Anaconda's vice president in charge of operations, has been elected a director of Greene Cananea Copper Co., Chile Copper, Chile Exploration and Andes Copper. All of these men have had distinguished careers in the mining industry.



R. S. Newlin

Luther C. Campbell, has received an award for outstanding leadership in coal research. The award was given at the annual banquet of Bituminous Coal Research, Inc., in Pittsburgh.



L. C. Campbell

Currently a coal mining consultant, **Campbell** is former vice president of Eastern Gas & Fuel Associates, successor to Koppers Coal Co. He is chairman of the Coal Division of the American Mining Congress and is past president of National Coal Association.

Olaf P. Jenkins has joined the firm of **Carroll E. Bradberry & Associates** as a consultant in economic geology. **Jenkins** was formerly state mineralogist and chief of the Division of Mines for the State of California.

Paul Morton has been named president of Cannelton Coal & Coke Co. and Lake Superior Coal Co., succeeding **Frank O. Harris**. **Harris**, who



Paul Morton

retired after more than 48 years of service, will be retained as consultant and will continue active on the board of directors of the coal companies.

A graduate of the New Mexico School of Mines, **Paul Morton** was associated with **Ames Mining Co.** as superintendent from 1942 to 1952. In 1952 he undertook the duties of general manager with **Royalty Smokeless Coal Co.**, leaving in 1953 to accept the position of assistant to the vice president of Cannelton and Lake Superior coal companies. In 1956, **Morton** was made vice president and general superintendent, and in 1957 executive president.

M. O. Evans, chief engineer of Republic Steel Corporation's mining division, has retired after more than 40 years' service in coal mine work.

Gordon B. Carson, vice president of Ohio State University, has been elected chairman of Ohio's newly-formed Underground Gas Storage Board of Review, State Industrial Relations Director **Hugh D. Wait** announced. **Kenneth Cottingham**, retired chief geologist for Ohio Fuel Gas Co., was named a member of the board. The board hears appeals of orders issued by the State's Division of Mines in connection with enforcement of a new law to prevent seepage of gas into coal mines.

Alexander C. Brown, chairman of the board of Cleveland-Cliffs Iron Co., was cited by the Cleveland Chamber of Commerce at its annual meeting in April as a man who has devoted his diverse abilities to the advance of Cleveland in both material and cultural affairs. The citation continued by saying that for 50 years he has been an eminent representative of the past, the present, and the future in the life of the Cleveland community, carrying forward a pioneer tradition in the twin fields of iron and coal and their necessary complement of navigation on the Great Lakes, always with their future development in mind.



Alexander C. Brown is one of Cleveland's safety pioneers. He has wholeheartedly sponsored the cause of safety ever since 1919 when he became the first president of the Cleveland Safety Council. In April, 1952, recognizing his contribution to safety, the Cleveland Safety Council presented him with a testimonial acknowledging his untiring energy and intense devotion to the task of promoting safety in all lines of action and endeavor.

The Wyoming Mining Association announced the results of the recent elections:

Glenn Sorensen, president of Kemmerer Coal Co. was elected president. M. L. Sisson, superintendent, Colorado Fuel and Iron Corp., is the new vice president and H. D. Hand, president of Glove Mining Co. was re-elected as secretary-treasurer.

More than 180 leaders in business, industry and government honored L. F. Pett, retiring general manager of Utah Copper Division, Kennecott Copper Corp. in a testimonial dinner at Salt Lake City in April. Pett retired May 1, after five years as general manager of the firm. He joined the company in 1922 as a computer in the Division's engineering department at the Bingham mine.

Utah's governor George D. Clyde spoke briefly noting that Pett's "achievement in connection with the Bingham pit exemplifies men who have confidence in their vision and faith in their own abilities."

John A. Coe was recently elected chairman and Richard M. Stewart president of American Brass Co. The post of board chairman had been vacant since the retirement of Arthur H. Quigley in September 1955.

Stanley B. Johnson has retired as president of Lorain Coal & Dock Co. and chairman of the board of Lorado Coal Mining Co., but will continue as a director of both companies. Stanley B. Johnson, Jr., executive vice president of Lorain Coal & Dock, will become president of the firm. He also is president of Lorado Coal Mining. Robert L. Seith, secretary-treasurer of both companies and vice president of Lorado, has been named vice president of Lorain.

R. N. Hunt retired on May 1 as vice president and chief geologist of United States Smelting Refining and Mining Co., but will continue as director in that company and on the board of Hecla Mining Co. He will continue to live at 2684 Hillsden Drive, Salt Lake City.



S. B. Johnson



S. B. Johnson, Jr.

Frank R. Milliken has been appointed executive vice president of Kennecott Copper Corp. He has served as vice president in charge of the company's mining operations since joining Kennecott in 1952.

Milliken began his professional career as a research metallurgist at a zinc concentrating plant in New Mexico. Following this he progressed through various technical and operating positions in the mining industry, including a period as experimental engineer with Kennecott's Utah Copper Division. In 1952 he received the Robert H. Richards Award of the AIME for his contributions to the minerals industry.

W. Lunsford Long of Warrenton, N. C., has retired as board chairman of Haile Mines, Inc.



Sam Clark of Summersville, W. Va., assumed the duties of president of Mid-State Coal Mining Institute at the eighth annual membership banquet. Vice presidents for the new year are Louis Fyock, T. E. Lafferty, A. P. Littleton, Virgil Bean, and G. R. Bragg. W. B. Goff was re-elected secretary and treasurer.



— Obituaries —

Paul H. Hunt, 75, one of Utah's most prominent mining executives for many years and a former member of the state legislature, died of a heart attack April 17 in Fresno, Calif. Mr. Hunt retired in 1955 from his post as consultant and member of the board of directors of United Park City Mining Co.

Paul Hunt served as general superintendent of Park Utah Consolidated Mining Co. from 1925 to 1946, and vice president and general manager from 1946 to 1953 when the firm merged to become United Park City Mining Co. He had been employed since his retirement in research and development work for The Anaconda Co.

An active worker in Utah politics, Mr. Hunt was a frequent speaker on mining and economic problems. He served in both the Utah House of Representatives and the State Senate, and was a Wasatch County commissioner. He was a member of several tax study committees in the state and had served on a Federal committee to study organization and operation of the Bureau of Land Management in 1953.

Ralph C. Beerbower, retired mining official, passed away April 30 at his home in Forest Hills, Pa. He was 72 years old.

During his long career Mr. Beerbower organized the mining department of West Penn Power Co. and opened its first two coal operations; served as a mine supervisor for H. C. Frick Coal Co., a general superintendent of the Washington Coal & Coke Co., and was a district manager of Goodman Manufacturing Co.

Joseph Vear Hansen, 62, of Salt Lake City died at his home April 17 after a brief illness. Mr. Hansen was one of Utah's prominent mining and business men.

Joseph E. Parker, an engineer for the Wedge Wire Corp. died suddenly April 23. His home was in Terre Haute, Ind.

Alfred Taylor Patterson, 64, superintendent of Lorado Coal Mining Co., passed away after a short illness on April 7. Mr. Patterson had worked for the company since 1934.

William Bradley Hayes, 54, of Man, W. Va., died at his home on April 8. He was safety director for the Amherst Coal Co., where he had been employed for the past 30 years.

John Harris Hearing, Sr., 93, former assistant general manager of U. S. Steel's Oliver Iron Mining Division died in Duluth, Minn., in March.

NEWS and views



Site Chosen for Coal Research Center

Bituminous Coal Research, Inc., recently announced that University Park, in Monroeville, near Pittsburgh, Pa., has been chosen as the site for development of a campus-type research center to serve the nation's bituminous coal industry. Initial plans call for construction, starting probably early next year, of a \$1,000,000 laboratory-office structure in which all of the organization's research operations, now scattered among three cities, will be consolidated. As the need arises additional buildings will be erected. Nearly 100 persons are expected to be employed ultimately at the Coal Research Center.

In addition to basic research on the origin, physical properties and chemical behavior of coal, the new and expanded program will stress development of improved coal handling and utilization methods. More information will be sought on the use of coal as electric fuel, for production of industrial steam, for space heating and in relation to coke production. Research also will be conducted in the fields of gasification, chemical and other process uses of coal.

L. C. Campbell, former vice-president of Eastern Gas & Fuel Associates, Inc., and chairman of the Coal Division of the American Mining Congress is national chairman of the fund-raising committee.

Direct Reduction of Iron Ore

A simple process for direct reduction of iron ore to pig iron or semi-steel has been developed and demonstrated by Strategic Materials Corp. and Koppers Co., Inc., in a prototype plant at Niagara Falls, Ont. Engineering and cost studies indicate the commercial feasibility of the process for use near ore sites and where relatively inexpensive electrical power is available. The process does not appear to be immediately competitive at existing major steel production centers. However, trends in the cost of coking coal, power, and trans-

portation as well as increases in capital costs, could improve the competitive position of the process.

Known as the Strategic-Udy Process, the reduction method is simple in operation. Iron ore is mixed with fluxes and a low-cost source of carbon (for example, bituminous coal, anthracite, etc.). This mixture is fed into a direct-fired rotary kiln where it remains a free-flowing system of solid particles discharged at 1100 to 1300° C., depending upon the type of ores used.

From the rotary kiln, the hot charge is immediately directed into the reducing zone of the electric furnace, where a short arc is held slightly submerged in the slag. This provides an intense, hot zone in which the charge is quickly and completely reduced. Reduction can be effectively controlled so that pig iron or semi-steel can be produced, and slag additions can be made to control impurities so as to produce a metal equivalent to or superior to pig iron with respect to elements such as silicon, phosphorus and sulfur. The metal may then be cast into pigs or transferred in molten form to a refining furnace, where alloying additions may be made if desired, to produce steel. The process thus provides for the direct and continuous production of steel from iron ore.

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West Virginia Mine Girds for Production

The first trial run at the preparation plant of the \$18,000,000 Love-ridge mine, one of the world's largest, was recently made. Mountain Coal Co., formerly Consolidation Coal Co. of West Virginia, expects regular production to start this spring. The mine will have a potential capacity of 3,000,000 tons of coal per year but will begin operating with an actual capacity of about 1,500,000 tons annually. Located near Fairmont, W. Va., it is one of three operations, described as the ultimate in present day mechanization, being put into action by Consolidation Coal Co., parent concern. The West Virginia operation will produce steam coal for the general market.

All-Time Low in Accident Frequency

An all-time safety record was set by the iron and steel industry last year. The industry's rate was 3.48 disabling injuries per million man-hours worked. This low record was a 12 percent reduction as compared to 1956 and contrasted sharply with the 1926 accident frequency rate of 32 per million manhours worked.

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Aluminum Plant Nears Completion

Construction of the aluminum production facilities of Olin Mathieson Chemical Corp. and Ormet Corp. is more than 80 percent completed. The plants are located on the Ohio River between Clarington and Hannibal, Ohio, and are expected to be completed this summer. A combined work force of 2200 persons will be used when the plants reach full production, expected to be by the end of 1958.

Ormet, jointly owned by Olin Mathieson and Revere Metals, will pour its first metal this spring, using alumina shipped by barge from Louisiana. The new firm will become the nation's fourth largest producer of primary aluminum, with an annual capacity of 180,000 tons. The adjoining Olin Mathieson rolling mill will have an annual capacity of 120,000 tons of flat and coil-rolled aluminum products.

Big Loader Nearing Completion

The \$7,000,000 conveyor-belt system nearing completion at the Presque Isle coal and ore docks of the Chesapeake and Ohio Railway is believed to be the biggest and fastest device anywhere in the world for loading coal into ships.

The project is described as the largest single investment thus far to prepare the port of Toledo for St. Lawrence Seaway business. C&O officials say it was planned with Seaway cargo in mind. The Fried Krupp firm of Rheinhausen, Germany, designed the loader and manufactured the parts.

Hanna Coal Plant Put Into Operation

Hanna Coal Company's coal preparation plant, which will furnish fuel for the Kammer power plant, has started operation. Located near Moundsville, W. Va., the preparation plant is part of a large industrial complex which includes Hanna's Ireland mine. The plant is capable of eventually processing some 3,000,000 tons of coal annually.

Coal is conveyed from the mine on a 60-in., mile-long conveyor belt to the preparation plant. It is then carried by belts to a transfer station where it can be diverted to the Kammer power station, a proposed river dock or proposed new chemical plants in the vicinity.

The Kammer power plant converts the coal into electricity for the Olin Mathieson and Ormet aluminum facilities at nearby Clarington, Ohio.

Rail-Ship Service Starts

Chicago and Eastern Illinois Railroad and the Gartland Steamship Co. inaugurated a combined rail and water freight service for shipment of Illinois and Indiana coal to Great Lakes

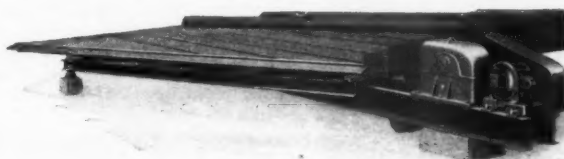
ports. The combined service is the first ever negotiated by a railroad and lake carrier, according to David O. Mathews, president of C&EI.

The Gartland steamer Frank E. Taplin loaded the first consignment of 7500 tons of coal on the Calumet River and departed for Sheboygan, Wis.

The rail-water rate will save about 45 cents per ton on coal shipments to lake ports. "The combined shipping rate will help miners in depressed areas of southern Illinois and Indiana," Mathews said, "and we anticipate that this movement will involve as much as one million tons per year within 12 to 24 months."

Multimillion Dollar Salt Mine Planned

International Salt Co. expects to spend \$10,000,000 on a salt mining operation centering on Cleveland, Ohio's, Whiskey Island. Research and tests which were started in 1955 indicate that 170,000,000 tons of salt can be extracted from a 5100-acre area under Lake Erie. The mine will be located 1800 ft below the surface and is expected to be in commercial production in 2½ years. It will ship Sterling rock salt to a large market, including most of Ohio, western Pennsylvania, West Virginia, and the Great Lakes region. Processing equipment will be installed at the mine.



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Mining Leader Receives Coved Award

Raymond E. Salvati, one of West Virginia's outstanding industrialists and civic leaders, recently received a coveted 1958 Horatio Alger Award.

Salvati richly deserves the reward he received. Youngest of four children of an Italian immigrant, he realized early that the burden of financing his education would rest on his shoulders, and worked his way not only through college but high school as



well. After graduation from West Virginia University, Salvati entered the employ of Island Creek Coal Co. in 1922 and rose to become president of that company—the world's third largest coal producer.

Along with seven other prominent business and professional leaders at ceremonies in the Waldorf Astoria Hotel in May, he became only the second West Virginian in history to receive the award. Thomas E. Mill-sop, former president of Weirton Steel Co. and now head of National Steel Corp., won the award in 1952.

In accepting the award Raymond E. Salvati found himself in the company of former President Herbert Hoover, Elder Statesman Bernard Baruch, Dr. Milton Eisenhower and Charles E. Wilson, former president of General Electric. All received awards in previous years.

The Horatio Alger Awards are presented each year by the Horatio Alger Awards Committee of the American Schools & Colleges Association. The award derives its name from the fictional Horatio Alger novels of yesterday. The novels stressed the American free enterprise system which enables a youth to rise above humble beginnings and attain success in his field by hard work, honesty, and determination.

Sunnyhill Coal Buys Tipple

Sunnyhill Coal Co. has purchased the tipple of Broken Aro Coal Co. from Peabody Coal Co., and is studying the probability of reopening the mine. The tipple is located near Wellston, Ohio.

Third International Coal Preparation Congress

The Third International Coal Preparation Congress will take place in Brussels and Liege, Belgium, June 23 to 28, 1958. Technical visits are organized during this week and the following week.

The organization has been undertaken by the Institut National de l'Industrie Charbonnière (Inichar), 7, boulevard Frère Orban, Liège, Belgium.

The Congress deals with the preparation of coal smaller than $\frac{3}{8}$ -in. Qualified specialists have written 67 papers for presentation—several of them dealing with maximum efficiency in coal preparation and use of coal in coke ovens and power stations.

All the papers will be published in English, French and German before the Congress opens. The technical sessions will be held at Liege, and will be heard in the three languages with simultaneous translation.

Canadian Mineral Interests Sold

Premier Joseph Smallwood of Newfoundland announced recently that the Province has sold its interest in the Newfoundland and Labrador Corp. (Nalco) to Canadian Javelin for account of that company and Wabush Iron Co., Ltd.

Nalco has mineral and timber concessions for over 24,000 square miles in Newfoundland and Labrador. It was originally incorporated by the government of the Province of Newfoundland to promote the industrial and economic development of the Province, and to develop its natural resources.

The operations at Nalco will be under the direction of Pickands Mather & Co.

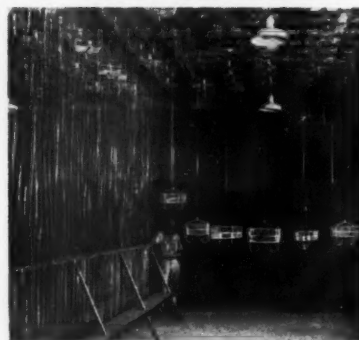
ALSO . . .

Missouri School of Mines, Ohio State and UCLA were chosen as institutes to receive federal grants for the installation of a nuclear training reactor.

According to a report from the Missouri Division of Resources and Development, approximately \$300,000 already has been received from the Atomic Energy Commission for the purchase of the reactor, and the state legislature has approved an appropriation of \$50,000 for the construction of a building to house it.

Plans are rapidly being developed at Missouri for housing and installing the 10-kw reactor of the "open pool" type. It will be similar in concept to the 1955 device built by the United States and Geneva, Switzerland, for the Atoms for Peace International Conference.

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A coal-loading record was established when the Chesapeake and Ohio Railway recently dumped 413 hopper cars into one ship at its Newport News, Va., tidewater terminal of the railroad. A total of 25,611 net tons of nut coal was dumped into the holds of the Holland-bound S. S. Leader, a bulk carrier of Panamanian registry.

The best monthly safety record in nearly 50 years was established by American coal mines during March, according to the Bureau of Mines. Fourteen fatal injuries were reported for that month.

Director Marling J. Ankeny said that detailed monthly records of the Bureau regarding coal-mine fatalities date from 1912 and that the low number of deaths in March 1958 may have set a monthly record dating back even before 1912. In recent years, the previous low month for deaths was October, 1957, when 22 fatalities were reported.

South Africa's largest and most expensive gold mining enterprise, located 50 miles west of Johannesburg, has started development work. Over \$56,000,000 will be spent on the Western Deep Level mine. The mine will be eventually 12,000-ft deep and is expected to be in production for 60 years. It will take over six years to bring the mine into full production.

The recently completed coke testing laboratory of Consolidation Coal Company's Research and Development Division at Library, Pa. is nearing capacity of about 1,500,000 tons at the end of its "shakedown." Officials are enthusiastic about its current performance. The laboratory has been built to provide improved quality control of Consol's coal, help solve customers' problems, and to evaluate specific coals or coal blends which are not currently in industrial use.

Construction of the Wisconsin taconite pelletizing plant of Ashland Mining Co. will start sometime next year, according to William B. Cudlip, president of the firm. The plant will be built near Butternut, in the extreme northeastern part of the state.

Bids for the \$26,000,000 Cramet, Inc., titanium plant at Chattanooga, Tenn. are being received by the General Services Administration. The bids are to cover land, buildings, and equipment, but not raw materials and supplies. These will be offered separately later. There are no restrictions as to keeping the facilities intact ready for the production.

Merger of Armco Steel Corp. and National Supply Co., under discussion for years, has become a reality. The transfer of properties and assets of National Supply to Armco was completed at the close of business April 30. National Supply then became an Ohio corporation and a subsidiary of Armco.

When workmen whitewashed a 100,000-ton coal dump people in the English town of Lynemouth expressed astonishment. The National Coal Board had a ready reason. "If anybody steals any of our coal the break in the whitewash will stand out like a black eye."



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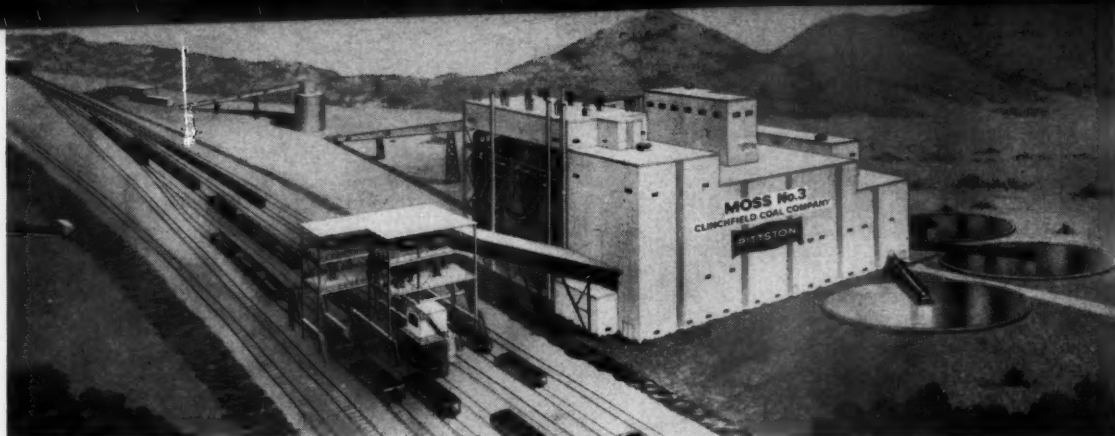
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New Coal Plant to Be Built in Virginia

Clinchfield Coal Co., a division of The Pittston Co., has awarded Link-Belt Co. the contract for one of the largest automated coal preparation plants ever built in this country. The announcement was made jointly by both companies.

The new plant, located at Clinchfield, Va., will be known as Clinchfield's Moss No. 3 and will wash, dry and screen 1500 tons of run-of-mine coal per hour. Scheduled for completion during the latter part of 1958, the plant will utilize dense-media separation for the preparation of both metallurgical and steam coal. Plant design includes dual facilities

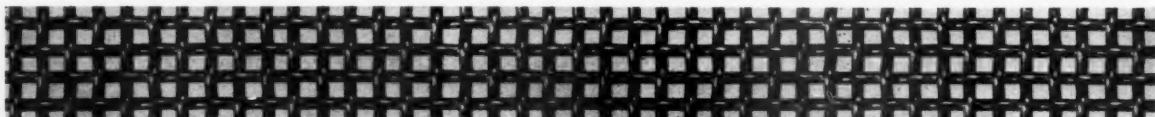
and stand-by equipment to permit maintenance during operating shifts.

One of the features of the new plant is a filtration system for fine coal and fine refuse. A minimum amount of makeup water will be required and stream pollution will be avoided by filtering, treating and re-using the plant water.

Another unusual feature is the 2500 ft long turn-over slope belt conveyor to carry refuse from the plant to a nearby mountain top for disposal. This type is used to avoid build-up of material on the underside of the belt, as well as on the idlers or rollers over which the belt passes.

The belt is turned over after discharging the material and returns with the top side of the belt up on the return. At the bottom of its run, the belt is turned again to its normal position. The mine refuse is transferred from the slope belt conveyor to a traveling belt conveyor stacker for final disposal.

Coal will be delivered from the mine to the new Moss No. 3 preparation plant, a seven-mile distance, by railroad which will run 8500 ft through a mountain tunnel now under construction. The tunnel will eliminate the construction of 30 miles of railroad track.

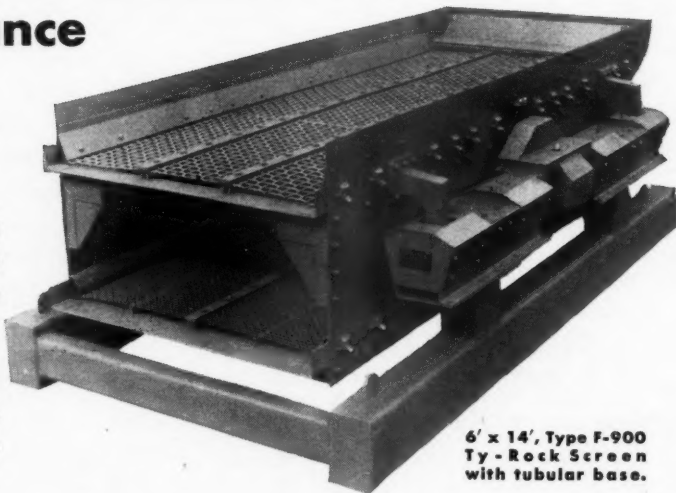


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NEWS and views



Summary of AEC Plans

The action taken by the AEC to expand domestic uranium procurement somewhat will provide an additional market for ore reserves developed prior to November 1, 1957. It is anticipated that additional procurement contracts for mill concentrate will result, increasing total milling capacity by about 3000 tpd of ore and increasing annual concentrate production by about 2500 tons of U_3O_8 .

This action results from a study made by the Commission of the marketing problems arising from the October 28, 1957, announcement of a Commission policy to limit further expansion of domestic concentrate production. The study disclosed that as of November 1, 1957, five areas had either no market or an inadequate market. The estimated minimum requirements for additional mill capacities in these areas are as follows:

Areas	New Mill Capacity Tons Per Day
Southeast Texas	600
North Dakota-South Dakota (lignites)	600
Wyoming	1700
Colorado Front Range	200
Nevada (Austin)	200
Total	3300

According to the AEC, six areas have adequate mill capacity if it can be distributed equitably among the mining properties:

White Canyon-Monument Valley, Utah-Ariz.
Eastern Wyoming-Black Hills, S. Dak.
Salt Lake City, Utah (Area tributary to the Salt Lake City mill).
Moab (Big Indian Wash), Utah.
Grants, N. Mex.
Spokane, Wash.

The following areas have an adequate market for ore produced from the known mines:

1. Uravan Mineral Belt, Colo.
2. Cameron District, Ariz.
3. Shiprock District, N. Mex.
4. Lakeview, Ore.
5. Baggs-Maybell, Wyo.-Colo.

The AEC has under study the question of licensing private uranium sales subject to appropriate safe-

guards to assure that material sold would be used for peaceful purposes.

The Commission expressed the view that it is in the best interest of the Government, and the uranium industry, to prevent over-expansion of uranium production facilities, and that new capacities provided to purchase contracts should be held to the minimum.

The AEC also recently reported that about 78,000,000 tons of uranium ore have been blocked out in the United States. The ore averages 0.27 percent uranium oxide. States with the largest reserves were listed in the following order:

	Tons
New Mexico	53,000,000
Wyoming	9,000,000
Utah	5,700,000
Colorado	4,100,000
Arizona	1,400,000
North and South Dakota	600,000
Washington, Oregon, Nevada	1,900,000
Montana, Idaho, Alaska, California, Texas	1,900,000

Beneficiation Research

The results of research on concentration of Spokane area autunite by flotation were recently described by William C. Aitkenhead, director, and John A. Jaekel, metallurgist, of the mining experiment station of the Washington State Institute of Technology at Washington State College. Low-grade uranium ores have proved amenable to froth flotation, and high grade concentrates along with excellent recoveries have been obtained from some of the ores.

Most of the work has been done on the argillite ore from the Midnight mine on the Spokane Indian reservation. The original goal of a one percent uranium oxide with a 90 percent recovery from this ore which contains less than 0.2 percent uranium oxide has not been obtained. However, recent work on samples of granite type ores from Mount Spokane achieved an 11.2 percent uranium oxide from an ore containing 1.27 percent uranium oxide, with a recovery of 97.8 percent. Other tests on Mount Spokane ore gave encouraging results.

Excellent results were also obtained from Dalh lease ore of Northwest Uranium Mines.

An excellent collector for autunite has been found but there are innumerable combinations of reagents and other factors still to be studied.

Another goal of the mining experiment station is utilization of now worthless oxidized zinc ores in North-Eastern Washington. Froth flotation of six percent zinc ore from Pend Oreille Mines and Metals Company's old Josephine open-pit in the Metaline district resulted in a better than 40 percent concentrate and recoveries up to 70 percent.

Kennecott Buys Asarco Smelter

Approximately \$20,000,000 will be paid for inventories of material and supplies, adjacent real estate and certain other assets of the Garfield Copper Smelter. Located near Salt Lake City, the smelter is owned by American Smelting and Refining Co. and the actual transfer of title is not expected to take place until January 2, 1959 with Kennecott Copper Corp. taking over operations at that time. Until then Asarco will continue operation in accordance with present arrangements.

The Garfield Copper Smelter was built in 1906 and has subsequently been enlarged and modernized to where it is now the largest copper smelter in the world, processing approximately 625,000 tons of concentrate yearly.

Under Asarco's ownership the smelter at times treated substantial tonnages of custom ores from other Western mines. Most of these custom ores will be treated in the future at other Asarco smelters. Kennecott does not intend to enter the custom smelting business. Acquisition of the smelter is another step in Kennecott's integration of its copper producing facilities and operations, while at the same time the smelter sale provides Asarco cash for use in its broad diversification into production of industrial raw materials.



EXIDE-IRONCLAD BATTERIES

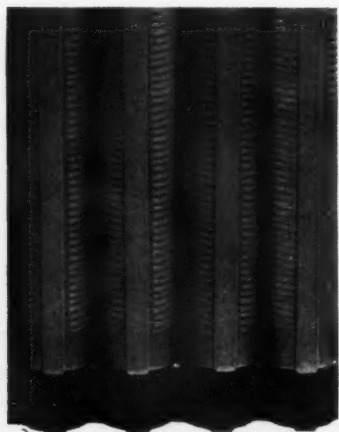
—best buy for the long haul

More ton-miles per dollar—that's the reason most cost-conscious mine operators prefer Exide-Ironclad Batteries for mine locomotives.

Experience has proved over the years that no other battery make matches Exide-Ironclad for average life in service and tonnage hauled. Rating for rating and dollar for dollar, Exide-Ironclad gives you more real value . . . more return on your investment.

Today's Exide-Ironclad features improved tubular construction, making it even better than the models that chalked up the industry's records. So you can expect even longer life potential and superior performance.

Total work output, not mere price, is the key to battery economy. When you buy batteries, specify Exide-Ironclad and get the most production capacity your dollar can buy. For details, write Exide Industrial Division, The Electric Storage Battery Company, Philadelphia 2, Pa.



High-capacity, long-life tubular construction. Gives positive plate one-third more surface area for greater power reserve. Power tubes hold active material securely for long battery life.

Exide®

Tunnel Record Set

A new world's record for drilling was established in March when workmen drilled 1363 linear ft of tunnel in 26 working days at Kennecott Copper Corporation's mine at Copperton, Utah. The 18 by 24-ft ore haulage tunnel is scheduled for completion in June 1959.

Utah Construction Co. is overseeing the \$12,000,000 project with Paul C. Guinn as project manager. The record-breaking drilling activities were directed by M. F. Finlay, general superintendent.

At an average rate of 45.5 ft a day, the tunnel has been pushed a total distance of over 11,000 ft by an average of 180 men working around the clock six days per week. The ultimate length will be 18,000 ft.

During the record-setting month of March, 350,000 cu yd of rock were removed from the tunnel.

Largest Blast Successful

The largest non-atomic blast in history—using more than 2,750,000 lb of blasting agents—leveled Ripple Rock to climax efforts that started 15 years ago. The two massive underwater peaks of rock which have menaced navigation, taken scores of lives, and wrecked more than 100 vessels in the narrow strait separating Vancouver Island from Maud Island, have been called the worst hazard to navigation on the West Coast of North America. The total cost of the project is expected to be \$3,100,000.

ALSO . . .

History was made recently by U. S. Smelting Refining & Mining Co. in moving Dredge No. 6 from Gold Hill to Sheep Creek. It was the first time a dredge has been moved on land without dismantling the hull. The dredge was floated onto special sleds and then 18 large tractors were put to use—three D-9's, 10 D-8's, and five HD-19's and HD-20's. The three D-9's were used as pushers and the remaining 15 pulled. At the start, a delay was caused by too much push from behind resulting in a jammed steering mechanism, but otherwise the operation was completely successful. The company will operate seven dredges in the Fairbanks area this year, but will reduce stripping and thawing activities. No new dredging ground will be prepared because of increasing cost.

Sand and gravel were the most economically important minerals mined in Washington last year, with production valued at \$15,500,000, according to the State Division of Mines and Geology.

A uranium pilot mill with an estimated capacity of 50 tpd is being built by Cotter Corp. of Santa Fe, N. M., southwest of Canyon City, Colo., and is expected to be in operation by August 15. The mill is designed to process most of the types of uranium ore available from front range producers. Owners are seeking permission to expand the capacity to 200 tpd to provide producers with a processing plant in their own area for the first time.

One of the earliest operating mines in America was a gold mine in the Cerillos, or Little Hills, south of Santa Fe, N. M. Early in the 17th century, Indians engaged in placer mining under the supervision of Spanish colonists.

Homestake-New Mexico Partners uranium mill near Grants, N. Mex., played host to an estimated 800 spectators during dedication ceremonies a few weeks ago. Keynote speaker at the dedication ceremony, Dr. Donald H. McLaughlin of San Francisco, president of Homestake Mining Co., reviewed the history of the Ambrosia Lake area near Grants, which within a few years has become the center of two-thirds of the Nation's known uranium reserves. The mill capacity is rated at 750 tpd and is one of four authorized mills for the area.

Zinc-lead ore production at Fend Oreille Mines and Metals Co. in Metaline Falls, Wash., hit a record high last year. Jens Jensen, president of the company which is Washington's largest producer of base metals, disclosed that drilling and underground work has indicated that the mine is able to supply enough ore for a 10,000 tpd operation—provided the market improves sufficiently to warrant such expansion.

The Pacific Northwest cement market will be served by a large cement storage and distribution terminal to be built by Ideal Cement Co. of Denver, Colo., on the Columbia River at Vancouver, Wash. Ideal entered western Washington markets and established itself in the Pacific Northwest last October with the acquisition of the plant and other assets of Northwestern Portland Cement Co. The company's president, Cris Dobbins said, "Ideal believes the Pacific Northwest is one of the best growth areas in the entire United States."

Open-pit uranium mining at the Happy Jack properties of Texas-Zinc Minerals Corp. in the White Canyon area of Utah, completed a conversion from underground methods. Ore is processed at the Texas-Zinc uranium mill at Mexican Hat.

The best mine safety record in Idaho for 1957 among mines having 250,000 man-hours or more of work belongs to the Galena mine of American Smelting & Refining Co. in Wallace. George McDowell, state inspector of mines, awarded a safety plaque to the company.

Gold purchases to hedge against inflation amounted to more than \$100,000,000 in Western Germany during 1957. The American Eagle, with a nominal value of \$10.00 and gold content of about \$15.00, is now quoted at \$21.50 by sources in that country.

Western coal deposits near Hanna, Wyo., will be utilized by Columbia Western Corp. in its new coal carbonization plant. The \$1,750,000 plant is expected to be in operation by August 1959. Columbia Western spokesmen said the firm has contracted to purchase 1000 tpd of coal from Wycoal Co., which holds purchase option of Nugget Coal Co. property at Hanna.

The Grand County, Utah, potash project of Delhi-Taylor Oil Corp. is moving right along, according to a report given at its annual meeting. Three core wells in the new area at Cane Creek have been completed and plans to take a large core from a drilling oil well on the property have been made. Information from these and other wells in the area have proved a high grade deposit of adequate size for commercial operation, it was reported.

Columbia-Geneva Steel's coal cleaning plant near Wellington, Utah, processed nearly 100,000 tons of coal during its first full month of shake-down operations. Full-scale operations are now under way as major construction work on the plant was completed several weeks ahead of schedule. Capacity of the plant is rated at 600 tph. Raw coal for the cleaning plant arrives in railroad cars from company mines near Dragerton, Utah, and Paonia, Colo. The coal is used in the company's Utah steel works.

Idaho's Conjecture mine in the Coeur d'Alene District will be brought into production by Federal Uranium Corp. of Salt Lake City. Installation of equipment and shaft collaring will be completed soon and a crushing plant for the silver ore will be installed adjacent to the hoisting plant.

Merger delays of Atlas Corporation subsidiaries allowed some of the companies concerned to re-estimate their reserves, but it is now expected that the merger plans will move forward, according to Floyd B. Odum, Atlas president. Among the principal Atlas affiliates to be merged are the wholly-owned Hidden Splendor Mining Co. and the Lisbon Uranium Corp., both

with headquarters in Salt Lake City, and Rio de Oro Uranium Mines Inc., of Albuquerque, N. Mex.

The Silver Peak, Nev., mill of United State Mining and Milling Corp. successfully completed pilot runs and is in operation. The renovated facility includes a cyanidation process and a new flotation system.

Coal lands may provide power site for future expansion of Reynolds Metals Company's primary aluminum capacity. Reynolds recently exercised its option to purchase approximately 1500 acres of coal lands adjoining Lake DeSmet near Buffalo, Mont., but gave no indication if it will construct an aluminum reduction plant there. Extensive drilling tests have been conducted in the area to determine the feasibility of constructing a plant. The power potential at Lake DeSmet is greater than the present total of installed power in the entire state, according to Reynolds' officials.

A new mining company known as Callahan Mining Corp. has been formed from the merger of Callahan Zinc-Lead Co. and Vulcan Silver Lead Co.

Opposition to proposals of the United States tariff commission for increased duties on lead and zinc were voiced by the Canadian Metal Mining Association. It urged the Canadian Government to protest to the Administration "in the strongest terms." It was the association's contention that implementation of such recommendations, even the less drastic of the two proposed, would close down more Canadian mines and aggravate unemployment and their unfavorable trade balance with the U. S.

Further investment in foreign lead-zinc operations offers one of the few alternatives to going out of business, provided the Government does not grant the necessary tariff protection to the domestic lead-zinc mining industries, Andrew Fletcher, president of St. Joseph Lead Co., told the New York Society of Security Analysts recently. Fletcher said he did not believe any Congress would permit such an alternative being forced on the company or on the domestic industry.

A beryllium processing chemical plant costing \$250,000 will be erected by Mineral Concentrates, Inc., of Denver in Loveland, Colo. The plant will produce beryllium hydroxide from beryl ore mined in the Crystal Mountain area about 35 miles northwest of Loveland. A company official said the plant will purchase ore running as low as four percent beryllium, a much lower grade than some beryllium buyers in the nation will accept.

The tough ones come to Card

How HOMESTAKE solved two HAULAGE PROBLEMS

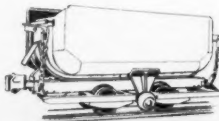
When Homestake Mining Company needed larger haulage capacity, Card engineers were called in. At Homestake, ore cars are automatically dumped while in motion, and haulage ways are limited in cross section. So, special Granby-type cars were chosen to replace the old gable-bottom cars.

Since 1939, 390 of these special Card cars have gone to Homestake on eight successive orders. Designed for maximum capacity, they have only a very minimum of side clearance. They are fabricated wholly of Cor-Ten plate and hold 60 cu. ft. Greatest design change over the years has been to a heavier liner plate to allow loading without the degree of ore fragmentation originally planned. Originally the cars were loaded through 14" grizzlies. Now they are loaded with the largest sizes that will clear the chutes.

Card has recently furnished 61 special Rocker Dump cars for development work at Homestake. These are well suited to handling waste and dumping in old stopes.

WHERE MINING CALLS

for efficient haulage, Card cars are the tested answer. Join Card's many customers. Their repeat orders are added proof of quality for you. Card engineers are at your service . . . no obligation.



C.S. Card Iron Works Co.

2501 WEST 16th AVE.
DENVER, COLORADO

A 75,000 kw steam-electric plant contract has been awarded by Utah Copper Division of Kennecott Copper Corp. to Rust Engineering Co. of Pittsburgh, Pa. This will hike capacity at the facility near the Magna copper concentrator to 175,000 kilowatts at a cost of about \$16,000,000.

\$400,000 of Hecla Mining Co. stock has been purchased by Callahan Zinc-Lead Co. of New York.

Expanded shale will be produced by British Columbia Lightweight Aggregates, Ltd., on Saturna Island in the Gulf Island group near British Columbia. The plant will cost about \$600,000 and is expected to be in operation by the spring of 1959. It will serve markets in the Victoria and Seattle areas.

The National Coal Association's Vocational Training and Educational Committee, at its semi-annual meeting in Golden, Colo., discussed plans for a short film to be used in high schools to show students the work of a mining engineer in college and immediately after graduation. The general impression was that more attention could be given to the development of films and less to advertising in magazines published for high school students and teachers.

Dolomite to line open-hearth furnaces at Columbia-Geneva's steel mill near Provo, Utah, will soon be processed at the new \$3,000,000 mill being constructed near Dell, Utah, by Utah Marblehead Lime Co.

Coeur d'Alene mining region has yielded \$1,738,218,797 in lead, silver, zinc, copper and gold since 1884—the first year of recorded production. The record year was 1951 with an output valued at \$65,058,887. Production last year was worth \$47,459,665.

The largest order for fabricated titanium in history has been placed with the Titanium Corporation of America by Freeport Sulphur Co. The order calls for fabricating about seven miles of seamless extruded and re-drawn titanium pressure tubing for chemical application at Freeport's Moa Bay, Cuba, operation. The tubes will be fabricated at Henderson, Nev.

Uranium-bearing lignite ore in North and South Dakota continues to attract interest. International Resources Corp. has submitted a proposal to the AEC offering concentrates at a competitive price. The uraniferous lignites have no market at present because they can't be processed in any mill currently operating or under construction. Deposits are near Bowman, N. Dak., and are estimated to contain sufficient reserves to justify building a mill with a capacity of 600 tpd.

A new terminal at Grants, N. Mex., for stocking chemicals used in uranium processing has been officially opened by Dow Chemical Co.

A large body of low-grade copper ore, amenable to open-pit mining, has been delineated by Banner Mining Co. at its Daisy Mine near Tucson, Ariz., according to a recent report to shareholders. The grade and reserves of the newly expanded ore body, however, were not disclosed.

A \$2,500,000 expansion program at the Oregon Metallurgical Corp. titanium and zirconium processing plant was recently announced. Ingots produced at the facility are processed from sponge obtained from nearby operations of Wah Chang Co. Oregon Metallurgical recently received a \$4,000,000 contract from Westinghouse Electric Corp. for zirconium ingots.

Coronado Copper & Zinc Co. a wholly-owned subsidiary of Cyprus Mines, has closed its Wallace, Idaho, exploration office.

Pacific Northwest aluminum plants poured a direct cash flow into the area of more than \$151,000,000 in 1957, according to figures released by Raw Materials Survey, Inc., of Portland, Ore.

WHEELS OF GOVERNMENT

(Continued from page 95)

Congress again opposed the principle of premerger notification, as was done last year before the House Judiciary Committee, and urged that if any such legislation is enacted, it provide an exemption for acquisitions of the mining industry of its "stock in trade." The argument pointed out that the acquiring of reserves was a day-to-day procedure in the mining industry and any delay imposed by Government would cause serious difficulties.

Recently when testifying before the Antimonopoly Subcommittee, Chairman Celler (Dem., N. Y.) of the House Judiciary Committee declared he was going to "smoke out" the House bill, now bogged down in the Rules Committee. Celler stated, "I am not going to wait much longer. At a suitable time, I am going to move to suspend the rules. I believe we can muster enough votes." To bring a bill to the House floor under such a procedure would require an affirmative vote by a two-thirds majority.

COAL LEASE BILL GETS PUSH

A House Interior Subcommittee has tentatively approved a revised bill to double the acreage of public lands within any one State which may be held under a coal lease. The measure, somewhat similar to a bill passed by the Senate last year, would boost the

3,000,000 barrels of cement will be supplied by American Cement Corp. for the Glen Canyon Dam and power plant on the Colorado River in north central Arizona. A \$9,700,000 contract was awarded by the Bureau of Reclamation.

Creosote treated pine utility poles can be potentially dangerous. A number of tests by the Baltimore Gas & Electric Co., have led to the conclusion that electrical equipment mounted on such poles "is not sufficiently insulated from ground to be safe, and that linemen who consider such equipment to be insulated are under the wrong impression and perhaps lulled into a false sense of security." Creosoted poles cannot be depended upon as good insulators and ungrounded metallic pole-mounted equipment, such as transformers, should be regarded as partially grounded or energized. The company said that the study "points to the need for metallic grounding all pole-mounted current-carrying equipment so that conditions will be known and respected."

The Alaskan mercury prospect of Sunshine Mining Co. will be explored by a comprehensive diamond drill program. The property is about 60 miles northeast of Goodnews Bay.

acreage limitation from 5,120 to 10,240, and, if certain conditions are met, to a total of 15,360.

The Senate bill, S. 2069 by O'Mahoney (Dem., Wyo.) and Barrett (Rep., Wyo.), would also delete a provision of the Mineral Leasing Act which sharply limits the use by railroads of coal produced from leased public lands. Since there is no reference to this provision in the language approved by the House Subcommittee, differences in the bills may ultimately have to be ironed out in a Senate-House conference.

URANIUM MARKETS EXPANDED

Sales of uranium ores and concentrates may now be made to domestic and foreign buyers for peaceful uses under a new policy adopted by the Atomic Energy Commission. The AEC also announced that consideration will be given to release of uranium now under contract to the AEC, subject to contract modifications. Almost simultaneously with the American announcement, the Government of Canada notified Canadian producers of uranium that foreign sales of uranium would be permitted under some regulation.

All American sales will be subject to licensing by the Atomic Commission under regulations which are yet to be drawn up. After a request for a license is received, the AEC will investigate the proposed end-use of the uranium. If in the Commission's

opinion it is for peaceful purposes, the Commission will issue a license for export to countries having comprehensive agreements for cooperation with the United States against diversion of uranium to military use. The United States has such agreements currently with Australia, Belgium, Canada, Federal Republic of Germany, France, Italy, Netherlands, Norway, Spain, Switzerland, Union of South Africa and the United Kingdom.

Government agreements are not necessary if the shipments amount to no more than 220 pounds of contained normal uranium to a single foreign consignee, provided that no country receives more than 2200 pounds from various exporters in this country.

COAL RESEARCH BILLS NOT MOVING

Although House hearings were held in April on bills to establish a Coal Research and Development Commission, with the job of conducting an over-all research program to stimulate the production and consumption of coal, no further action has been taken.

Subcommittee Chairman Rogers (Dem., Tex.) indicated recently that the measures, which have strong coal-industry backing, would be taken up later this year, but has not yet set any date for their consideration.

STOCKPILE UPGRADING URGED

Chairman Murray of the Senate Interior Committee and 18 other Senators have offered a resolution urging the Government, through the appropriate agencies, to initiate programs to convert chromite and manganese ore and concentrates and other raw materials to a "state of maximum immediate usefulness."

Murray said such upgrading "will result in lessening the unemployment in some of our hardest hit areas; and, in addition, it will strengthen our national defense and will result in stockpiling electric power, labor and transportation which undoubtedly will be in critical short supply in times of emergency."

The resolution was referred to the Senate Committee on Government Operations. As yet no hearings have been scheduled.

Meanwhile, the General Services Administration announced recently that approximately 300,000 long tons of low-grade Mexican manganese ore located at El Paso, Texas, will be sold. The ore averages about 30.47% contained manganese and will be sold either on the basis of "where is, as is, all or none," or on the basis of out-loaded weights and analysis "all or none." The ore is offered with U. S. customs duty paid.

BARTER OPPOSED AT HEARING

The Department of Agriculture is opposed to any expansion of the
(Continued next page)

1958 MINING SHOW

Program for San Francisco Metal Mining Industrial Minerals Convention and Exposition Rounding Info Shape

MEMBERS of the American Mining Congress from all over the United States have been hard at work organizing the 1958 Mining Show to be held in San Francisco, September 22-25.

National Program Chairman Frank Coolbaugh, vice president, Climax Molybdenum Co., met this month with the State Chairmen of his committee to map out final program plans for nine sessions on general and policy matters and twelve operating sessions.

Changes in the economic picture and rapid advances in the many technologies involved in the mineral producing industries make it tougher each year to draw up a program that will cover all of the important subjects that must come before the convention. The program committee has met this challenge by selecting an outstanding group of speakers, all of whom are eminently informed on their subjects and capable of giving their audiences the greatest amount of information in the shortest time.

Excellent Exhibits Planned

The equipment manufacturers are outdoing themselves this year in their plans to show more and newer machines, supplies, and services than at any previous AMC exposition. With the addition of the new Civic Center Exhibit Hall, the facilities in San Francisco are ideal, and the exhibitors are prepared to give mining men all possible help in their efforts to attain lower costs and greater efficiency.

Committees at Work

A successful convention requires lots of planning and detailed work by well organized and ably directed committees. John D. Bradley, president of The Bunker Hill Co. and chairman of the Western Division of the American Mining Congress, is the General Chairman and has been the spark-plug behind the scenes. Assisted by vice chairman E. A. Hassan, Jr., manager, Exploration Department, Kaiser Aluminum and Chemical Corp., Bradley has found able and energetic help on every side. Jack H. How, president of Western Machinery Co., heads the Manufacturers division; Frank Coolbaugh is at the helm of the National Program Committee; W. Wallace Mein, president of Calaveras Cement Co., is taking charge of the welcoming committee; publicity is in the hands of committee chairman John L. Merrill, president of the Merrill Co. and vice chairman L. M. Holland, secretary of the mining committee of the San Francisco Chamber of Commerce, and J. A. Mecia, manager of the mining division of Utah Construction Co., is chairman of the trips committee.

Mrs. Paul C. Henshaw and Mrs. Jack H. How, co-chairmen of the ladies' hospitality committee, have worked diligently with their committee members in making arrangements for a special program for the many mining ladies who will attend the convention. Honorary chairmen are Mrs. W. Spratt Boyd, Mrs. Frank R.

Girard, Mrs. D. C. Jackling, Mrs. F. F. Kett, Mrs. Jules LaBarthe, Mrs. W. W. Mein, Mrs. H. R. Plate, and Mrs. George Starr.

Parties and Field Trips Planned

Social events at San Francisco will include the Miners Jamboree on Tuesday night at the historic Palace of Fine Arts, and the traditional AMC Dinner Dance—an informal, strictly speechless party at the Sheraton-Palace Hotel on Thursday night. Other evenings are available for seeing San Francisco, visiting or dining with friends, night-clubbing or what-have-you.

On Friday following the convention session, there will be a Tax Forum for all interested mining men and, by popular demand, another Salmon Derby and two interesting industrial field trips down the San Francisco peninsula. An added attraction will be a trip by air to San Simeon. Recently opened to the public, this "Arabian Nights" estate of William Randolph Hearst is high on the list of things to see in California.

Make Reservations Now

A record turn-out is expected for this, the biggest mining event of the year. San Francisco hotels will be able to accommodate all visitors, but those who have not yet made reservations should send their requests promptly to the AMC Housing Bureau, Room 300, 61 Grove St., San Francisco 2, Calif.

(Continued from previous page)

nearly dormant program of bartering surplus farm commodities for foreign metals and materials, Assistant Secretary Don Paarlberg testified recently before the House Agriculture Committee. Paarlberg said that expansion of the program would be a "serious mistake" since it could result in the disposal through barter of agricultural surpluses which otherwise might be sold abroad either for dollars or for foreign currencies.

Until the barter program was sharply cut back in May 1957, the U. S. Government had taken sizable quantities of foreign lead, zinc, and other minerals off the world market and stockpiled them, at the same time getting rid of much farm surplus. Reduction of this program has been blamed by many observers for the current glut of many metals and minerals in world markets.

Book Review

PRINCIPLES OF ENGINEERING GEOLOGY AND GEOTECHNICS

D. P. Krynine and W. R. Judd,
McGraw-Hill Book Co., Inc., New
York, N. Y., \$6.50

The main purpose of this book is to inform engineers on what they should know about geology and why; and to provide geologists and other specialists of the earth sciences with a knowledge of those phases of civil engineering necessary for their work with engineers.

Because the authors combine diversified practical experience with extensive teaching, they bring to this book an unusual blending of geological information with engineering. A unique feature of this work is the integration of geology with soil and rock mechanics. The relation between these branches of knowledge

has been treated only meagerly in the past; here, they are welded into such a workable whole that it appears that an entirely new speciality has been created.

The first eight chapters of the book contain general geotechnical information applicable to any structure. The next several chapters present the use of this information as an indispensable tool in the design and construction of buildings, bridges, dams, tunnels, runways, highways and shore structures. Special attention has been given to the work in the arctic and to earth work failures, such as landslides. Aseismic design is summarized in a brief chapter. A fine presentation of the legal side of geotechnics, particularly as it must be considered by a foundation specialist, is included in the book. Numerous examples of problems are provided, and references are listed at the end of each chapter.

manufacturers forum

Density Measurement System

DESIGNED FOR INDUSTRIAL USE, the AccuRay Density Measurement system is said to present a continuous, accurate measurement of density, specific gravity, percents solids, concentration, or related quantity. The system will make these measurements in liquids, slurries, or divided solids from the exterior of the pipe without contacting the measured material.

The density equipment is based on the absorption of radiation by materials. When rays from a radioactive source are directed through a material or absorber, the amount of radiation reaching a detector (placed opposite the source) will depend upon the mass of intercepting material.

Changes in mass per unit volume will change the amount of radiation absorbed, thus providing a basic measure of density, percent solids, specific gravity, or other similar quantity.

The radiation detector allows a current to flow which is proportional to the amount of radiation received. This current is then amplified and presented on a meter and/or recorder in the proper units of measurement. Control functions reportedly are obtained with little or no additional circuitry, depending on the control mode required and the characteristics of the process.

Typical applications, according to the manufacturer, include coal preparation and mineral processing. For further information write to Industrial Nucleonics Corp., 1205 Chesapeake Ave., Columbus 12, Ohio.

Slurry Rock Dust Distributor

FOR COMBATING THE EXPLOSION HAZARD created by coal dust in active work areas of bituminous coal mines, Mine Safety Appliances Co., Pittsburgh, Pa., is marketing the portable M-S-A Slurry Rock Distributor.

To assure a balanced blend of thick slurry discharge that will adhere to the ribs and roof of the mine, rock dust and water is agitated in the tank by a rotating impeller. The slurry product-mix is then discharged directly through the hose at the rate of 80 to 100 lb per minute at nozzle

pressure of between 10 and 20 lb, depending on the length of hose.

The nozzle allows the operator complete control of the flow of slurry. When the nozzle valve of the hose is turned off while the motor is running, the slurry is recirculated to the tank where the continuous agitation of the mixture prevents separation of rock dust and water.

The distributor—with its explosion tested motor and control of any desired voltage—is available in skid or rubber-tired mounting.

Inquiries about new equipment appearing in Manufacturers Forum are welcomed.

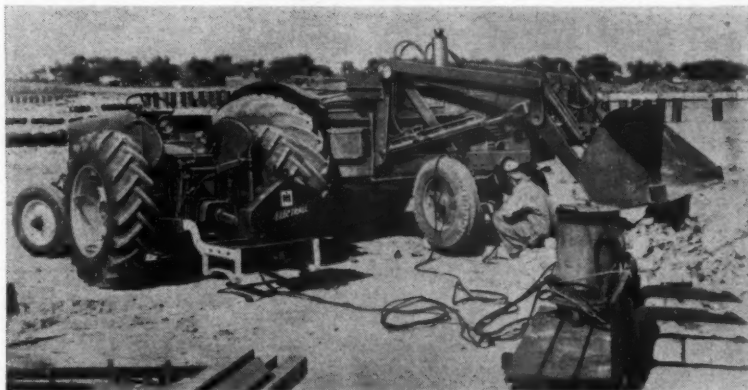
For additional information on any piece of equipment in this section write directly to the manufacturer, or to Mining Congress Journal with name of item and date of issue in which it appeared.

Lee-Norse to Remain Independent

DURING THE PAST YEAR, several plans have been considered by the Lee-Norse Co., manufacturer of the well-known Lee-Norse Miner, to enlarge its facilities to better serve the coal mining industry. Some of these plans included negotiations with other larger mining machinery firms for possible merger or affiliation. However, E. M. Arentzen, president, recently announced that the company has decided to continue its present setup in business as an independent manufacturer of mining machinery and will endeavor from time to time to enlarge its facilities so as to properly take care of the growing interest in its products.

In addition to the new model CM-37 Lee-Norse Miner, which was introduced earlier this year, the company is going into production of the LCM-28 "Low Coal" Lee-Norse Miner, which is designed for mining coal seams 30 to 48 inches in thickness.

Electrical Power Unit



A MOBILE POWER STATION, International Harvester Company's Electrall is now available as a Fast-Hitch or trailing model for use with any make 25 hp or larger tractor with A.S.A.E. std., 1½ in. diameter, 540 rpm p.t.o. Electrall reportedly finds its principal use as a standby electrical power unit for emergency use on construction work when power lines fail, or as a source of electrical power for jobs where regular power is not available. The unit is a mobile electric power station capable of de-

livering 12.5 kva continuously and makes this power available anywhere the tractor can be driven.

Electrall produces the same alternating current obtained from regular high lines—115 and 220 volts, 60-cycle, single-phase; or 208-volt, three-phase, 60-cycle for three-phase motors up to ten hp. Electrall's load capacity is listed at approximately 1800 watts at 115-volts; 6200 watts at 208-220 volts, single-phase; and three-phase motors up to ten hp on the 208-volt three-phase.

Horizontal Vibrating Screen

DESIGNED FOR DEWATERING, washing and sizing a wide variety of materials where head room is limited, the straight line horizontal vibrating screen can be cable suspended or floor mounted. Where conditions warrant, a combination of both mountings can be used.

CL-Model 58 achieves a high intensity motion by centrifugal force, unbalanced shaft vibrators. Two eccentric shafts in the vibrator, supported by oversize self-aligning bearings, are rotated by a helical speed gear reducer, giving the screen its straight line motion.

To facilitate removal for replacement of cartridge-mounted bearing, the gears are mounted on tapered shafts. A positioning rod, provided with the screen, enables maintenance personnel to support the shaft during any bearing change and keep it in a central position, thus avoiding the aggravation of repositioning a dropped shaft.

Screen decks are bolted to side plates. When a deck is worn and has to be replaced, it can be removed without taking out the entire screen frame.

The Straightline CL-Model 58 can be equipped with wash troughs,

electrically heated decks, bouncing ball decks—or in combination. Screen decks can be equipped to take wire cloth, perforated plates or wedge wire type of screening surfaces. Screens are made with single or double decks in 15 sizes ranging from 4 by 8 ft. to 6 by 16 ft.

Additional information can be had by writing to Link-Belt Co., Dept. PR., Prudential Plaza, Chicago 1, Ill.

Portable Hydraulic Motor Pump

WEIGHING 65 LB, the MP-27 electric motor pump is rated for 10,000 psi intermittent and 5000 psi continued duty, delivering 80 cu in. of oil per minute. It is driven by a standard ½-hp single phase, 60-cycle, 1750 rpm, 110-220 volt motor.

Besides being used with Tal hydraulic pipe benders, or any other make of hydraulic benders, pipe pushers, knock-out punches, hydraulic jacks of any kind, it can be installed and adapted to give power to existing equipment for pressing, pushing or pulling bushings, bearings, shafts, pump pistons, arbor presses, lifting operations, pre-stressing of conduit and other jobs.

For additional data write to Tal Bending Equipment, Inc., Milwaukee 2, Wis.

National Mine Service Acquires Greensburg Machine

ACQUISITION of the 38 year old Greensburg Machine Co. has been announced by Gordon MacVean, president of National Mine Service Co.

Greensburg Machine, located in Greensburg, Pa., will be operated as the Greensburg Division of National Mine under management of R. R. Schubert, who had been vice president and general manager of the firm.

Greensburg has manufactured and shipped storage battery locomotives to major coal and metal mines of this country and to mines and tunnel projects in Central and South America, Canada, Europe, Africa and Hawaiian Islands.

With acquisition of Greensburg Machine, another major step has been made by National Mine in the mining equipment field. Just one year ago, it announced acquisition of Clarkson Manufacturing Co., manufacturers of Clarkson "Redbird" Conveyor Chains and the Marietta Continuous Miner, and recently announced the exclusive manufacture and distribution of a new line of single prime mover shuttle cars—the TorKars.

Preparation Screen

THIS GUARD BAR SCREEN is most adaptable for flumes or vibrator applications, according to Wedge-Wire Corp., Wellington, Ohio. Designated the T-Wedge, the screen is actually a combination of the Wedge-Wire Corporation's Migh-tee and standard Wedge-Wire design. Elimination of actual guard bars is said to increase the total screening surface. The high T profile wire between every wedge-shaped wire performs as both guard bar and screen. The T-Wedge, constructed of stainless steel, can be interchanged with other types of Wedge Wire Kleenslot screens without mechanical changes.

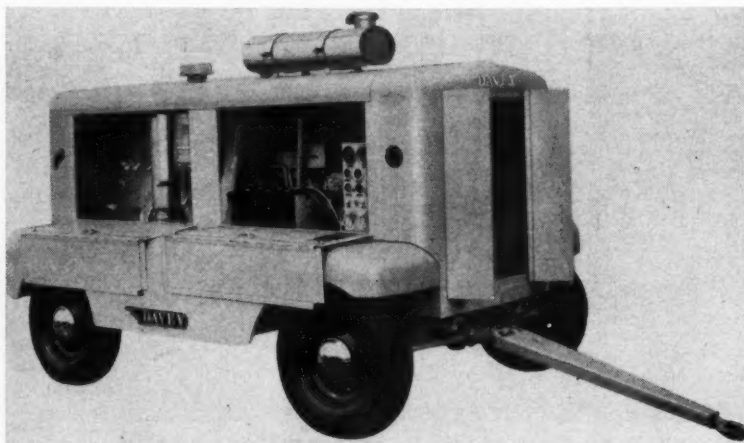
Self-Driven Head Pulley

A SINGLE UNIT conveyor drive, incorporating the motor, gears and all moving parts within the head pulley drum, has recently been introduced into this country from Germany by the George von Opel Corp., 15 William St., New York 5, N. Y.

It is claimed that space, time and power savings result from the compact design of the Bauer Self-Driven Head Pulley. Overhead V-belt drives and all the supporting superstructures and maintenance catwalks are eliminated. Maintenance is minimized and installation greatly simplified, according to the company.

Bauer pulleys are activated by three-phase induction motors with high starting torque and low starting current, ranging from 0.15 to 15 hp.

600 CFM Rotary Compressor



AVAILABLE IN FOUR WHEEL TRAILER and skid mountings, the Davey Hydrovane Rotary 600 is a multi-stage rotary compressor with a single free-floating rotor. The latter is so located that it is constantly concentric with one side only of the stator. Its blades are of the segmented type, inserted radially in longitudinal slots. They move continuously in a straight line from the stator center and reportedly cannot

cock or bind. While rotor turns and compression occurs, cooling oil is injected by means of two multi-stage cooling oil injection chambers.

The rotary compressor has both primary and secondary intake air-cleaners, three-stage oil separator and single adjustment vacuum-hydraulic, supply-demand control.

For complete data, write Davey Compressor Co., Kent, Ohio. Ask for form No. E-267.

Particle Size Analyzer

FOR MEASURING SIZE DISTRIBUTION of small particles, Mine Safety Appliances Co., Pittsburgh, Pa., has announced the M-S-A particle size analyzer. It was designed for particles between approximately 0.1 and 40 microns.

Major units of this analyzer system are special centrifuge tubes and a tube feeding chamber, an optical tube projector, and one or more special centrifuges. Three centrifuges reportedly were designed to assure reliability and provide constant speeds of 300 rpm, 600-1200 rpm, and 1800 rpm for predetermined times. A magnified image of the sediment column in a centrifuge tube is measured on a graduated screen of the M-S-A optical projector.

Basic steps in particle analysis are preparation of a suspension of particles, transfer of suspension to the feeding chamber and then into a centrifuge tube in such a way as to leave a sharp layer of the suspension on top of the sedimentation liquid. Sediment height is read before and after centrifuging at predetermined times and speeds. Size distribution is determined from sediment height data.

Huge Trucks for Peru

THREE 22-WHEEL bulk carrier rigs—said to be the largest off-the-highway units of their type ever built—were recently completed for shipment to Peru. They are designed to haul loads of 80 long tons of ore from the Marcona mine to the Pacific Coast port of San Juan, 250 miles south of Lima.

Each tractor and trailer is equipped with a hydrotarder braking system to help control the quarter-million-pound loaded weight of the units as they descend steep grades. This system makes use of a hydraulically-controlled water coupling in the drive shaft which, by varying the water pressure, acts as an additional braking system to supplement conventional brakes on each wheel.

A single-axle, four-wheel "jeep" coupled between the tractor and carrier permits distribution of the unit's loaded weight over all 22 wheels. The three-section rig measures 68 ft from bumper to bumper.

The ore gondolas, standing over 12 ft high, were designed and fabricated by Western Iron and Body Works Inc., Oakland, Calif. The 10 by 18-ft bottom dump hoppers were fabricated from a high-strength steel produced by Kaiser Steel Corp.

The rigs are powered by 335 hp, Kenworth model 848 tractors. The three tractors and the gondola trailer axle assemblies were built in Kenworth Motor Truck Company's Seattle plant. The "jeeps" were built by Fruehauf Trailer Co. at its Los Angeles plant.

—Announcements—

Louis A. DePolis has been named vice-president in charge of marketing for LeTourneau-Westinghouse Co. DePolis comes to the company from the Industrial Truck Division of Clark Equipment Co. where he has served as director of sales since 1953. In his new position, DePolis will not only direct LeT-WesCo sales organization but also supervise and coordinate all marketing and related activities.

Marion Power Shovel Co. announces the appointment of Ralph W. Kerr as assistant, to M. V. Cornell, vice president, large machine sales.

Gordon R. Wenzel has joined the staff of the Advertising & Sales Development Department of Nordberg Manufacturing Co. He will be responsible for all editorial services with the trade and business press.

Elbridge H. McNeill has been named Regional Sales Manager of the newly-formed Mid-West sales region of The Okonite Co.

D. B. Currence was appointed southern regional manager of Euclid Division, General Motors Corp. Currence replaces Charles B. Pace who resigned to establish a Euclid dealership in Kansas. Previously a Euclid representative in Colorado, Currence will guide the activities of district representatives in working with distributors in the region.

Austin Goodyear, formerly executive vice-president, has been elected president of Hewitt-Robins, Inc. He succeeds Thomas Robins, Jr., who had been president and chairman. Robins will continue as chairman and chief executive officer.

Appointment of Richard L. Engel as manager of Allis-Chalmers Industries Group Pacific Region has been announced by the company. Engel had been manager of the Group's Los Angeles district since 1953. He has been with Allis-Chalmers since 1939.

Donald E. Steele became manager of the Los Angeles district succeeding Engel. He had been manager of petroleum and chemical sales at Los Angeles since 1956.

Stratoflex, Inc., manufacturer of fittings and hose assemblies, has announced new officers of the company with headquarters at Fort Worth. They are: K. W. Davis, president and general manager; D. H. Thornbury, vice-president; C. A. Thomas, vice-president-sales, and John Tullis, vice-president-manufacturing.

Frank C. Senior has been appointed manager of the Development Section of the Engineering and Construction Division of Koppers Co., Inc.

Ronald J. Harvey has joined Marion Power Shovel Co. as staff assistant to the manufacturing vice-president.

CATALOGS & BULLETINS

HIGHWAY TRUCK TIRE DATA BOOK. B. F. Goodrich Tire Co., Akron, Ohio. Nine main factors within the control of truck owners and operators determine the degree of service that will be received from truck tires, according to a book published recently by B. F. Goodrich. It describes the nine factors as tire selection, mileage booster plan, inflation, loads and load distribution, mechanical irregularities, matching and spacing of duals, tire rotation, rims and retread before failure. The 42-page book also lists and describes the complete line of B. F. Goodrich truck tires, suggests safety

rules to follow in servicing truck tires, and carries tables on load and inflation and weights and measures.

SHOVEL-CRANE. Link-Belt Speeder Corp., Cedar Rapids, Iowa. Book No. 2553, covers the full one-yard LS-98 shovel, crane, dragline and hoe. With large photographs and descriptive copy, the catalog depicts the LS-98 in detail from the crawler tracks to the upper machinery and the various front end attachments.

(Continued on next page)

(Continued from previous page)

SAND AND GRAVEL JIG. *Meckum Engineering, Inc., Dayton Road, Ottawa, Ill.* Bulletin No. 800 describes the Meckum Sand and Gravel Jig. Designed for capacities up to 60 tph, the jig reportedly offers a low cost method of removing deleterious material from aggregate to meet State and Federal specifications. The device is said to incorporate the correct design theories which include the short bed, uniform pulsation, and positive stratification of the material.

PORTABLE PIPE LINE. *Steel & Tube Division, Republic Steel Corp., 224 East 131st St., Cleveland 8, Ohio.* Brochure describes mill grooved lightweight steel tubing for use as portable pipe line with standard mechanical couplings.

CRUSHING MACHINERY. *Traylor Engineering & Manufacturing Co., Allentown, Pa.* Two fully-illustrated bulletins concerning crushing machinery have been issued. Bulletin 6105 is devoted to Type H Jaw Crushers and bulletin 6637 is concerned with crushing rolls. Charts, specifications and information printed in the bulletins reportedly will enable operators to select crushers based on the feed and size required.

AIR PHOTO INTERPRETATION OF SOILS AND GEOLOGY FOR ENGINEERING PROJECTS. *Aero Service Corp., 210 East Courtland St., Philadelphia 20, Pa.* How air interpretation provides essential soils and geologic data for engineering projects is reported in a four-page folder. The folder also discusses the use of air photo studies to locate construction materials, determine trouble areas, aid route location, and to investigate excavation and foundation problems. Several examples of air photo interpretation are shown.

HOLD THAT ROOF! *Ohio Brass Co., Mansfield, Ohio.* Subtitled, "Suggested Installation Procedures for Safe Roof Bolting," this 27-minute sound color film uses animated cartoons and on-the-spot underground photographs to explain the subject to bolting crews and production workers. Topics covered include current theories of roof support, correct installation procedures, hole size, installed tension, torque, safety checks, and a discussion of how a roof bolt actually supports the roof. The film is available through O-B representatives for showings at individual mine properties. A 20-page, pocket-size "safety reminder" booklet, covering the important points made in the film, is also available for distribution to each member of the audience.

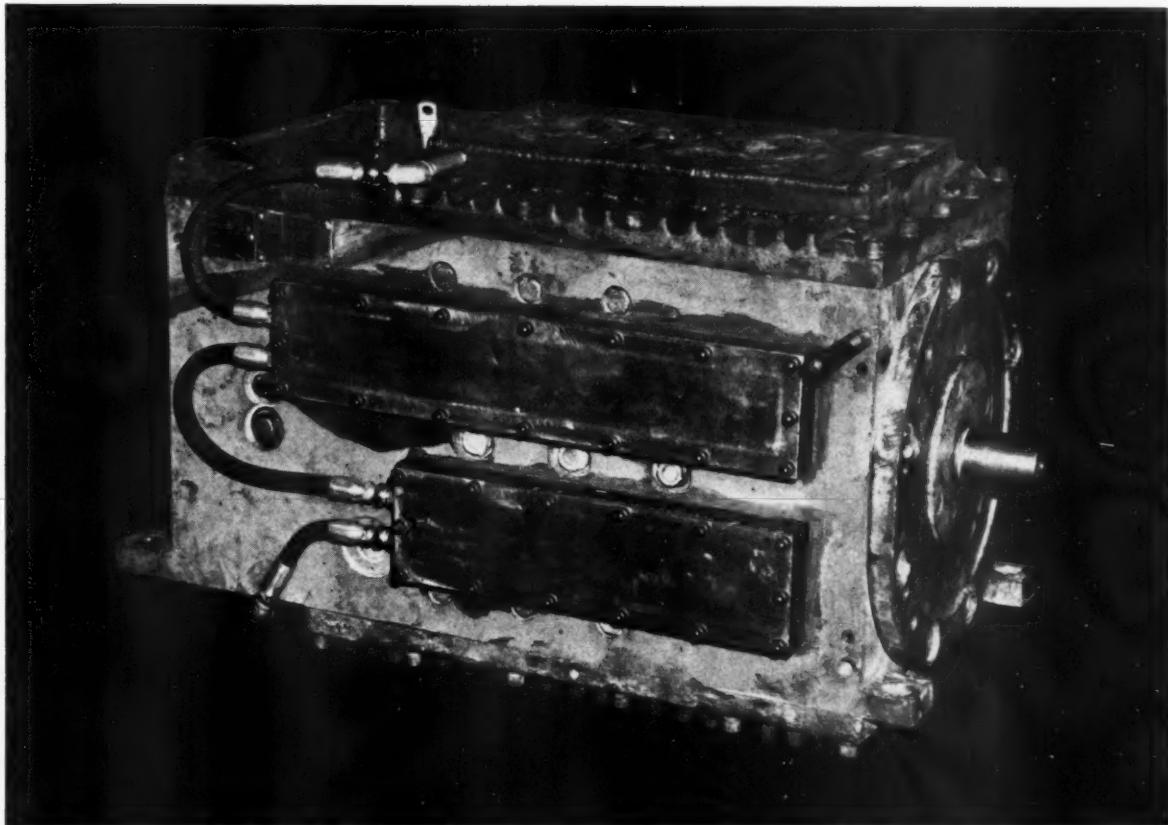
SELECT-O-GRAPH GUIDE. *Ranite Manufacturing Co., 616 South Marengo, Alhambra, Calif.* The shirt pocket size Ranite Select-O-Graph Guides reportedly offer an easy method for weldors to select the proper grade of hardsurfacing rods. The Guide carries the same indicative color coding as do each of the seven, job-graded, color-coded Ranite hardsurfacing rods. This affords the weldor a selection of the right Ranite rod for each particular job. On the inside of the fold-up flap is pertinent, basic information concerning performance characteristics of each rod, polarity, rod sizes, position information and Rockwell hardness. All this information printed on color bands is bracketed to indicate the kind of wear the seven rod types are designed to combat.

FITTINGS FOR HYDRAULIC HOSE. *W. D. Wynant, Parker Fittings & Hose Division, Parker-Hannifin Corp., 17325 Euclid Ave., Cleveland 12, Ohio.* Catalog 4440 describes reusable Hoze-lok fittings for use with rubber covered wire braided hydraulic hose in sizes from 3/16 through 1 1/4 in. inside diameter. Fittings are no skive type. Connecting ends offered include male pipe thread, straight thread with o-ring for SAE straight thread boss, Triple-lok 37° flare end, and swivel nut to mate with Triple-lok flare end.

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How NATIONAL Ingenuity Helped Solve A Tough Motor Maintenance Problem

This motor drives a continuous mining machine. Operation of the machine under certain unusual conditions caused overheating and eventual failure of the motor. National not only repaired the damaged motor but helped the customer plan modifications to prevent recurrence of the difficulty.

Water jackets (as shown in the photo) were added at carefully selected locations on the motor frame. Water used to spray the coal during the mining operation is first circulated through these jackets, thus bringing the operat-

ing temperature of the motor down well within workable limits.

An unusual solution, perhaps, but one which typifies the ingenuity which National engineers apply to the job of eliminating the cause of electrical equipment failures. Improvement, not merely repair, is always the objective.

For details on how National redesign ingenuity can help *you* eliminate your tough motor maintenance problems, just call your nearby National field engineer or drop us a line.

NATIONAL ELECTRIC COIL COMPANY

COLUMBUS 16, OHIO, U. S. A.

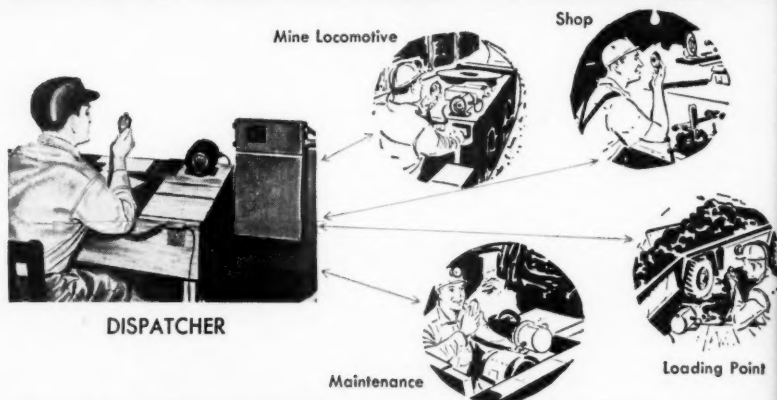


ELECTRICAL ENGINEERS: MAKERS OF ELECTRICAL COILS AND INSULATION—
REDESIGNING AND REPAIRING OF ROTATING ELECTRICAL MACHINES

Increase Your Production and Mine Safety with these M·S·A Communication Systems

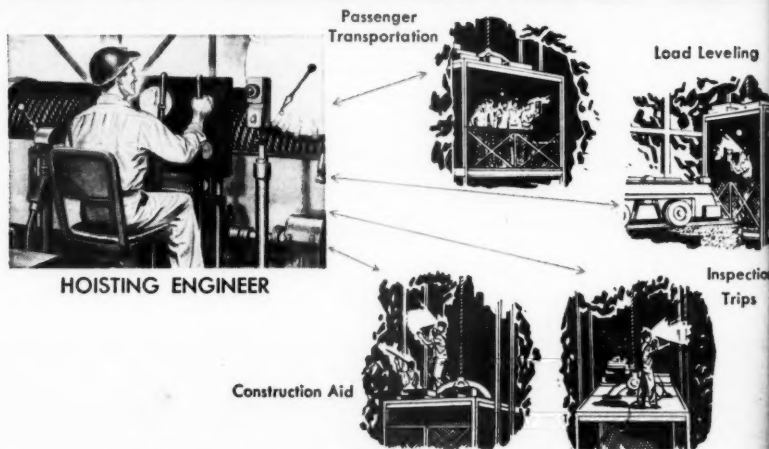
MinePhone

The M.S.A. MinePhone is eliminating communication delays in many modern mines everywhere. This clear, instant two-way voice communication system coordinates the wide variety of operations vital to peak production. Haulage moves faster because dispatcher and motormen are constantly in touch, even while trips are in motion. Shop and maintenance personnel are always "on call" to keep mining equipment in operation. Because messages are relayed instantly, on an open-line hook up, the MinePhone brings an added measure of safety to all operations. Write for details.



HoistPhone

The M.S.A. HoistPhone provides continuous, dependable and efficient voice communication between hoisting engineer and cage, at any level, and when in motion. The system is invaluable in emergencies, yet designed for day-in-day-out service. Ideal for passenger travel, load leveling, inspection trips, and construction work, the HoistPhone requires no special training; utilizes existing wiring. Write for complete details.



*When you have a safety problem, M.S.A. is at your service.
Our job is to help you.*

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At your service: 77 branch offices in the United States and Mexico

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